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Developing a Simple Treatment for an Unusual Gold Ore

By Algernon Del Mar

A Geological Gamble in Colorado

By Charles A. Chase

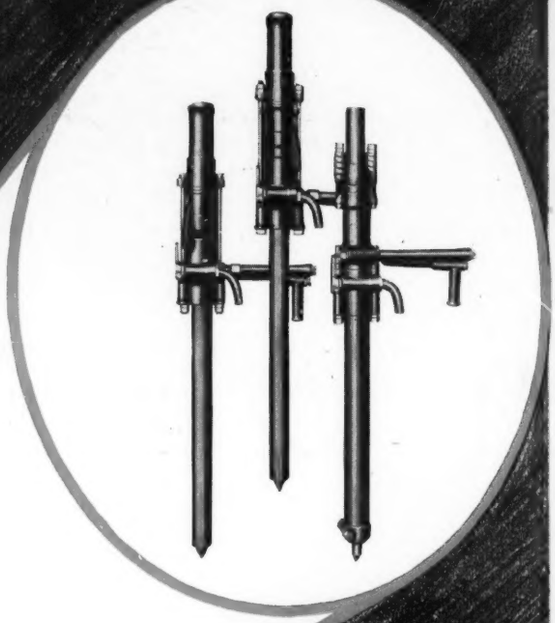
Scientific Management in Mining

By S. J. Truscott

Effect of Iron Contamination in Cyaniding

By E. M. Hamilton

In the Spotlight



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Big Cottonwood Mining District looking toward the Cardiff Mine

In this area, the Howell, the Tarbaby, the Price, the Kennebec, and other properties are carrying on development, a news story of which will appear in the August 17 issue of *Engineering and Mining Journal.*

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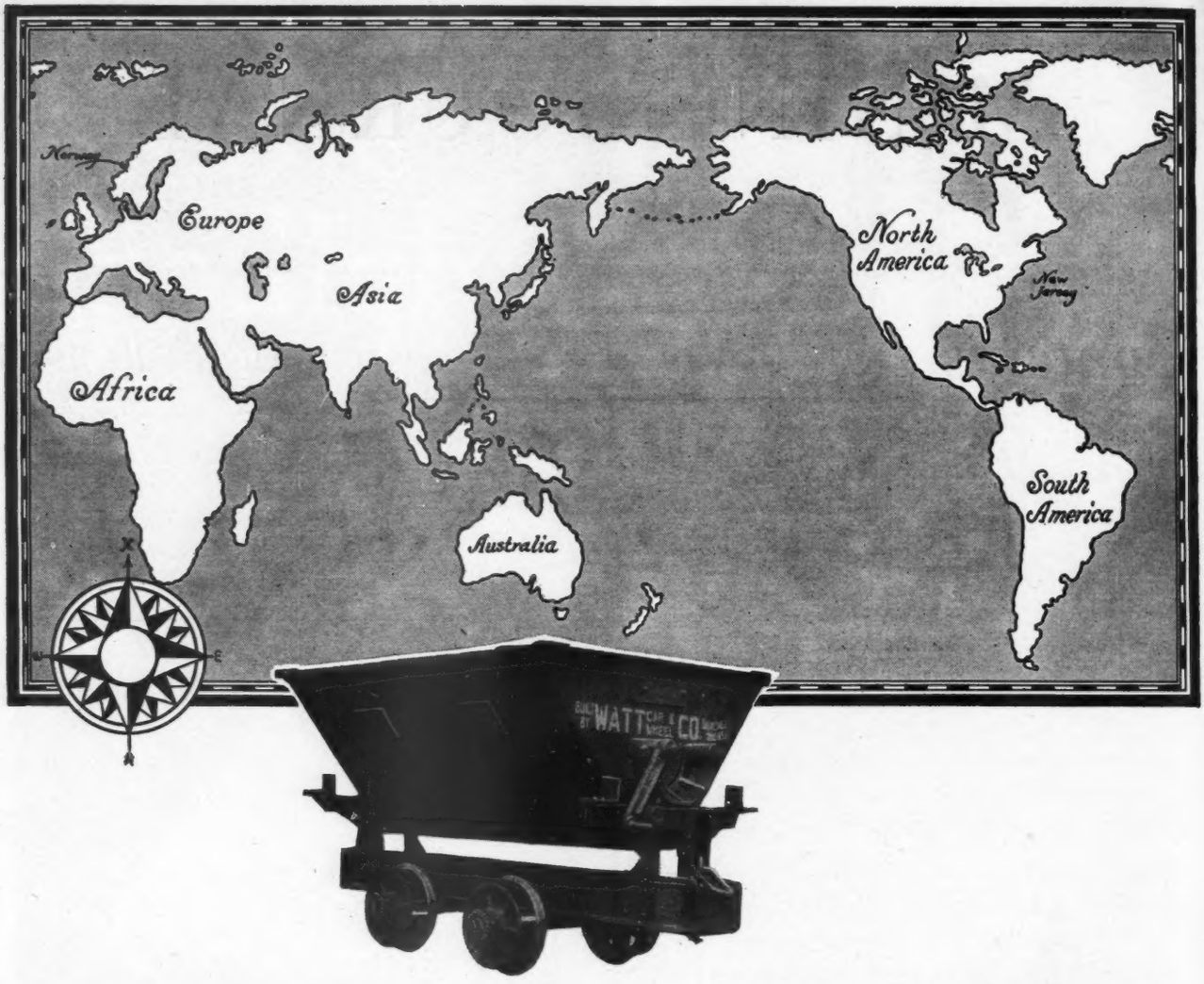

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Effect of an Embargo on Mineral Products in War

THE matter of the strategic importance of minerals bobbed up at Johannesburg last week. In delivering his presidential address before the British Association for the Advancement of Science, Sir Thomas Holland suggested what he thought was a more effective way of putting teeth in the Kellogg treaty for renouncing war than that provided in Senator Capper's resolution of last February. Instead of forbidding the export of "arms, munitions, implements of war and other articles for use in war," to quote the resolution, he would have the signatory nations simply refuse to sell "mineral products" to any of their number violating the pact. This, Sir Thomas thought, would obviate the need of deciding whether a shipment of commodities was intended to meet civil or military necessities—a question often painful and difficult, as his war experience had taught him.

Stoppage of mineral exports, however, would not prevent a war from starting. No embargo would be laid until after hostilities had begun. The early stages of hostilities would be conducted with previously accumulated supplies. And even though mineral products were sold to the offending nation, time would be required to work them up for use. Minerals are raw materials of use as war aids only in manufactured form. On the other hand, arms and ammunition can be used immediately on receipt. To permit their export and at the same time to embargo mineral products would seem illogical.

In any case, the proposed embargo would be unwelcome to those mineral producers whose shipments would be stopped. It would be considered discriminatory, providing the source of much complaint. The cost of enforcing the Kellogg pact would be borne by the mining industries, while manufacturers of myriad war supplies were merrily shipping their products.

Moreover, if, as Sir Thomas says, decision as between civil and military necessities is often difficult in war, this is as true where mineral products are concerned as it is in the case of food. Pursuits in no way connected with the conduct of war, and on which civilian welfare may depend, may require mineral raw materials.

A fairer and more logical proposal and, if anything, a more effective one, would be to include specifically in Senator Capper's resolution the words "mineral products." No way of avoiding the making of decisions as to contraband can be devised, unless everything be declared as such.

Exception may also be taken to Sir Thomas' assertion that the only nations that could fight long on their own resources would be the British Empire and the United States. He overlooks the effectiveness of the submarine in stopping the flow of supplies between the various units of the Empire. And the United States is far too dependent on other nations for many essential commodities to conduct a prolonged war successfully if cut off from the outside world.

Waste of a Valuable Byproduct Invites Technical Investigation

AN OFFICIAL report emanating from the Chilean government states that, "A study presented by Doctor Guzman, iodine expert, on the iodine situation has aroused much interest. It is brought out that Chile could be exporting iodine in a quantity ten times as great as she actually does, and is in a position to supply all the needs of the world without fear of her deposits being exhausted. To relieve this anomalous situation, Dr. Guzman proposes a state monopoly in order to lower prices and increase production."

Engineering and Mining Journal is glad to note that a protest and a warning that appeared in these columns in the issue of December 17, 1927, has been heeded. To repeat: "The iodine trade has remained stationary, with an appalling wastage at the source. The moral is obvious. If iodine and the iodides could be purchased at a reasonable price, uses would probably develop in several industro-chemical fields—in aniline-dye manufacture and for the refining of petroleum, for example. No industry ever achieved continued financial success by deliberate waste, and no progressive government can be expected to accept such waste as an inevitable concomitant to commercial operations of any kind."

Iodine is a byproduct of the Chilean nitrate-mining industry. Whether or not Chile is in a position to supply the needs of the world for this element depends on the extent to which those needs are discovered and developed by research. It is certainly able at present to meet all the demands likely to arise at a price out of all proportion to the cost of manufacture, and prohibitive so far as experimentation is concerned. The question of the exhaustion of reserves is one that should be studied in broader fashion than is evident from the press release quoted. No nation is doing right by its citizens, present and prospective, if it encourages or even sanctions so inexcusable a waste of a valuable byproduct as has occurred in Chile during the last 100 years. No one can say to what new uses iodine may be put in the years to come. To boil off the free element into the atmosphere, as has been practiced generally in Chile, is an economic crime. *Engineering and Mining Journal* has suggested that the

excess over present requirements might be recovered as copper iodide, at negligible cost, but technicians appear averse to a discussion of the subject.

In the meantime, the iodine situation in the United States has not remained stationary. Some progressive thinker and doer has evolved a scheme whereby iodine can be vaporized in a small apparatus, and the vapor applied direct to the infected or injured part. This simple expedient probably marks the greatest advance in the use of iodine as a medicament since its discovery. Contemporaneously, reports are current that another inquisitive scientist has discovered that iodine occurs in recoverable quantities in the salt water from certain oil wells in Oklahoma and California. If this be true, the probability is that the belated move to be made by the Chilean government will be too late. If iodine from such a source can be manufactured cheaply, independence from foreign supply will be achieved, and demand will be encouraged—by research—in harmony with supply. In such event, the history of the domestic United States iodine industry would parallel the recent history of the bromine industry in this country—greater output, lower prices, more extended use.

The corrosive action of iodine in nitrate plant liquors can be capitalized by the use of a cheap recovery process that takes advantage of such corrosion. The marketing of iodine and iodides at a reasonable price would greatly aid Chilean development and increase the profits from the nitrate-mining industry. As we have said before, the tail will never wag the dog, but additional income from byproducts is always helpful.

Metallurgical Technique Penetrates Chemical Industries

A LOGICAL and desirable expansion in new activities is a significant trend in the operation of the larger mining companies. As an example of progress in this direction may be cited the decision of the directors of Consolidated Mining & Smelting of Canada to spend seven million dollars on auxiliary plant in British Columbia, for the production of various byproducts.

Details of the program, recently released by Mr. S. G. Blaylock, vice-president and general manager, indicate that the decision is a sequel to an investigation by an International Joint High Commission to consider claims for damage to farm land in Stevens County, Washington, alleged to have been caused by fumes from the Tadanac smelter of the company. Even as popular interpretation maintains that it is an ill wind which blows nobody any good, so the outcome of the steps to be taken by the most important mining company in British Columbia reflects good business judgment and should insure increased profits. Moreover, a cause for litigation will be removed.

The announcement indicates that a new and large sulphuric acid plant will be erected, probably near the smelter at Trail; another plant for the fixation of atmospheric nitrogen; and a third for the electrolysis of water and the production of its gaseous elements. Phosphate rock, obtained from the company's mines at Fernie, will be treated with sulphuric acid; the hydrogen from the electrolysis of the water and the nitrogen extracted from the air will be united to form ammonia, with the ultimate production of several types of fertilizer. Oxygen will be the only remaining element from this series of by-product operations, but for this many uses can be found in the company's shops and metallurgical plants.

One highly significant outcome of a development of this character will be the injection into a strictly chemical process, or series of chemical processes, of engineering experience and skill. The chemical industries have borrowed freely of equipment developed by the metallurgist, but many instances might be cited that indicate a deficiency in engineering acumen in the design of a chemical method or the application of a chemical process. The metallurgist has contributed materially to the advance of technology in recent years. If he will penetrate a little more boldly into the domain of chemical engineering, he will find many opportunities for the exercise of those abilities that have had so potent an influence in effecting the cheap and efficient production of metals.

The Declining Interest in Mining Engineering as a Profession

WRITING in the current bulletin of the Mining and Metallurgical Society of America, Colonel P. E. Barbour quotes a captain of industry as saying:

"I want all my responsible men to be wealthy men. If I see a promising minor executive who may develop into one of responsible caliber, I do everything I reasonably can to help him to accumulate some of this world's wherewithal in substantial amounts. If he is no good, he will retire as soon as he can afford to. But if he does not retire, I almost invariably find that every penny I have put in him, and every financial advantage I have given him, is repaid to the firm many times over in his superior service."

Colonel Barbour uses this statement as a text to emphasize the fact that the rank and file of mining engineers are underpaid. When, he says, "an affluent mining company squeezes $10,000 worth of mental effort from a mining engineer to whom it pays $300 per month, and on whose judgment it depends for decisions in mining operations running into millions, it is doing nothing to develop that man into a shining asset for the company. "On the contrary," he maintains, "while the man may be most loyal and devoted to his employer, the lack of his progress toward affluence has a psychological reaction on him which eventually will reduce his worth to the level of the meager salary which the parsimony of the company dictates."

The tendency to which Colonel Barbour draws attention is less apparent in the United States than it is elsewhere, but few mining engineers of experience will not endorse his contention that the average treatment meted out to a technical member of a mining company's staff rarely indicates evidence of foresight and business acumen; occasionally it merits the use of the adjective "despicable."

Although an unfavorable generalization may seem justified, one should expressly except those business statesmen in the mining industry, generally engineers themselves, who appreciate the ability of the average

salaried employee to meet emergencies, to effect economies, and to assume multiple responsibilities. *Engineering and Mining Journal* agrees with Colonel Barbour that the industrial executive should pay more attention to the opportunities that exist for profitable investment in the encouragement of his own employees.

Domestic Barium in Place of Imported Strontium

THE history of the domestic strontium ore industry of the United States is an example of the stimulating effect of war necessity, followed by a prompt return to peacetime apathy. In 1916 an initial output of over two hundred tons was recorded, which rose to about four thousand tons in 1917, fell to about four hundred tons in 1918, and to nothing at all in 1919. The production came from mines in California, Texas, Arizona, and Washington, chiefly in the form of celestite, the sulphate, displaced after the armistice by the English ore landed on the Eastern seaboard, where it is treated for the recovery of strontium salts. Imports of strontium ore from England and of strontium salts from Germany are now valued at about $150,000 annually.

The chief actual and potential use of strontium, in addition to what is consumed in the manufacture of fireworks and flares, and in medicine, is in the recovery of sugar from low-grade beet molasses—by a method developed in Germany. A closed-circuit process results in a minimum loss of strontium. A saccharate is formed by the union of the salt with the uncrystallizable sugar in the molasses. This is decomposed by carbon dioxide, liberating the sugar.

Utilization of strontium for this purpose has made little headway in the United States, however, because of the peculiar characteristics of the domestic molasses; but after several years' experimentation a successful process has been developed by the research manager and the technical staff of the Great Western Sugar Refining Company, at Johnstown, Colorado, but using the hydroxide of barium instead of that of strontium. Barium carbonate is converted to barium oxide in the presence of barium silicate at furnace temperature. The clinker is ground and pulped in water, and the resultant liquor is cooled for the production of barium hydroxide crystals. The technique from then on is virtually the same as when strontium hydroxide is used.

The output of the Johnstown plant is about twenty-five million pounds of sugar per annum. Great Western, be it noted, pays the highest dividend of all the producers in the beet-sugar industry—a tribute to the value of a high-grade research staff. What was virtually a waste product, good only for the manufacture of yeast and as food for cattle, has been converted into high-grade sugar.

Many other domestic industries are dependent on the domestic mining industry; but, if the latter fails to respond to demand, an alternative product may promptly be substituted. Research has no respect for national aspirations or geographical limitations. More knowledge is a prerequisite to more economical operation. The truth may suffice to set a country free from major dependence on imported material.

Standardization Progressing in United States Industries

TO DEVELOP a standard for an industry and to persuade that industry to accept it is slow work at the best. Too many individuals must make up their minds as to what they want, as to the points they will yield, for standardization to proceed apace. The results of adopting standards may be far-reaching, and the problem in every instance must be pondered carefully. Speed is not to be expected of an organization which engages in such missionary labors. Rather, its progress is more likely to suggest that of a tortoise.

Up to 1928 the American Engineering Standards Committee, though handicapped by the nature of its work, suffered from other things as well. Red tape and lack of funds slowed down still more its already slow-moving machinery. Further retardation was caused by the fact that the same group of technical men was required to do the heavy thinking as well as the executive tasks, thereby placing upon their shoulders a burden that turned out to be too heavy.

Reorganization came last year, and out of it the American Standards Association. The progress of the new body may still at times suggest the tortoise, but it will undoubtedly be much faster than before. Races held since the time of Æsop have demonstrated that tortoises do have a speed changing mechanism as part of their anatomy and that they use it on occasion. Indeed, it will not be startling if this tortoise actually runs. But money will be needed to make it go; in fact, $150,000 or more per year—a small sum in comparison with the prizes to be won.

Achievements of the Association in the past year are set forth in its Year Book, recently distributed. Important new standards completed under its auspices include: a group of nineteen specifications and methods of test for various petroleum products; a comprehensive code for protection against lightning, including sections for protection of persons, of building and miscellaneous property, and of structures containing inflammable liquids and gases; standard track gages and car sizes for metal mines; a group of six specifications for bare and insulated copper wire (this being the first time that standard specifications for cotton, silk, and enameled magnet wire have been available); two more standards for pipe flanges and fittings; and specifications for track work, covering material for both steam and electric railways. About 150 national standards have already been completed.

The Association has planned an ambitious program. New projects initiated include: specifications for pressure and vacuum gages; for leather belting; for materials and workmanship for plastering; for coal mine cars; and a comprehensive code on mine timbering, including specifications for timber and a code of timbering practice. About 175 other national projects are already under way.

Evidence of the importance of the A.S.A. and of the work that it is doing is to be found in the list of almost 550 trade associations, technical societies, and other organizations that are co-operating with it in establishing standards under its procedure. Not fewer than 2,200 individuals, moreover, have been active in the work of the Association's technical committees engaged upon its projects.

Above, at the top left, Kendall Mountain, on the side of which, midway between the crest of the hill and Silver Lake mill, is the Aspen mine, an A. S. & R. property. At the extreme left is the Silver Lake mill, now idle. Animas River and the highway leading to Eureka appear in the left foreground. The framework of the new Shenandoah-Dives mill is in the immediate foreground. Sultan Mountain is shown in the distance; and in the valley the town of Silverton, from which roads to the right and left lead to Durango and Ouray, respectively.

Below, another view of the Silverton region. Office and mill structures in process of erection are shown at the left; in the middle center is Arrastra Gulch, halfway up which, at the left, is the Mayflower portal of the Shenandoah mine, on an outcrop, the position of which is indicated by the dotted line. Another view of the Silver Lake mill appears in the right foreground.

ROUND AND ABOUT SILVERTON, in the San Juan Basin of Colorado .... Two views of the country in which Shenandoah-Dives is building a plant.

A GEOLOGICAL GAMBLE

in Colorado

Meets With Success

By CHARLES A. CHASE

SINCE January, 1926, the Shenandoah-Dives Syndicate has extensively developed its holdings at Silverton, Colo., in the heart of the great San Juan Basin. Its properties consist of the unified holdings of the Shenandoah-Dives, North Star, and Mayflower groups, with a total length of 8,100 ft. along the main vein. These holdings are best shown in the longitudinal section of the properties which is reproduced on the following pages (pp. 204 and 205). The old Shenandoah and Highland Mary properties, which are now under the control of other owners, are also shown in this section.

This new enterprise, now in the hands of Shenandoah-Dives Mining, a Colorado company, was made possible by the work of two notable men. The late Dan MacLean succeeded Franklin Guiterman as manager of the Durango smelter nearly 30 years ago. At the smelter he appraised the resources of the San Juan Basin from the shipments of crude ore received, and appraised managements from the quality of preparation of ore for shipment. He began to lease as an avocation, but soon gave up his smelter connection and devoted the next twenty-odd years to active mining. Courageous and acute, he made large profits at Shenandoah-Dives and Highland Mary. He gradually bought and acquired control, and in 1925, shortly before his death, was able to contract the sale of the Shenandoah-Dives group as a unit. The Mayflower group was acquired from G. H. Malchus, a pioneer of the region. Starting years ago with an interest in Mayflower claim, obsessed with faith in the value of the vein, he acquired one interest after another, finally owning more than sixteen separate holdings. The last one he bought just in time to contract for its sale late in 1925.

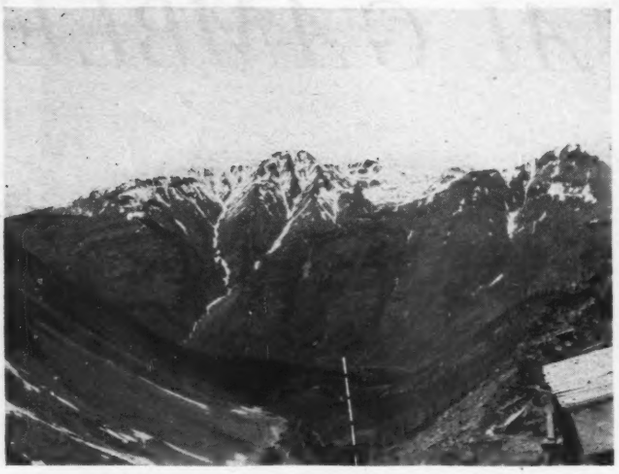
American Smelting & Refining contracted directly for a fractional interest in the Slide claim, which is included in the holdings. The New England Exploration Company, after an unfortunate experience in the application of gravity concentration to a galena grey-copper ore in 1902, was glad to sell.

Production from the claims making up the new property has been worth while, authenticated records showing $1,250,000 from Shenandoah-Dives, $2,000,000 from North Star, and $250,000 from Mayflower, all in net payments by the smelter. From the first two groups the production was of hand-sorted ore packed to the railroad, the North Star having been one of the best of the pioneer mines productive chiefly prior to 1893. Mayflower ore was milled inefficiently from 1916 to 1918. Shenandoah-Dives and North Star were essentially silver mines, also carrying lead and some gold; Mayflower production was largely gold, with silver, copper, and lead subordinate.

F. L. Ransome, in Bulletin 182 of the U. S. Geological Survey (1901), says in part of the North Star: "The pay shoot as a whole pitches to the southeast, apparently at an angle of about 45 deg." This would tend to identify the North Star shoot with that of the Dives claim, which had not been discovered at the time of this writing, and to discredit the area immediately beneath the North Star productive area. An engineer reporting on the Mayflower within the last decade stated that the enrichment there was secondary, the result of downward percolating waters, and that therefore ore was not to be expected at depth under the mountain. These two comments were adverse. We assumed that the Ransome conclusion might be based on too limited evidence, and saw that it could be confirmed by extending Shenandoah-Dives levels under the old North Star workings. Microscopic examination indicated definitely that Mayflower mineralization was primary.

With the longitudinal section before us, as it is presented herewith, except for the development we have done since, we evolved this hypothesis: The Mayflower mineralization being primary, and it being probable that

METAL PRODUCTION from Colorado has been decreasing for many years, and the mining industry of the state has generally been on the decline. In the San Juan Basin, however, conditions are in sharp contrast with those obtaining elsewhere in the state. At Silverton, Shenandoah-Dives has just started construction of a new 600-ton mill, the result of three and a half years of intensive development. The story of the project as presented herewith by Charles A. Chase, the manager, makes an unusually interesting and informative article.



Looking down Arrastra Gulch to the Shenandoah-Dives millsite, on the Animas River. The white line represents the proposed tramway.

ore deposition followed relatively closely after the outpourings of the Tertiary volcanics of the region, the Mayflower and Highland Mary deep ore were deposited at great depth from the surface. Their existence justified expectation of ore at similar horizons under the central mass of the mountain. The abundant copper, as chalcopyrite, in Mayflower suggested deep-zone enrichment, supporting our hypothesis. On the other hand, the deep ore in Highland Mary seems to be lead-silver. There, a local summit of the Pre-Cambrian rises into the Tertiary lavas, its top registering roughly with the bottom of the superficial bonanza, offering a different wall rock from that of Mayflower. The fact remains that ore existed at this great depth.

Our plan of operation was as follows: We were first to prospect under the old workings of the North Star. This was done in the first nine months of 1926, the two drifts being almost continuously in ore of mill grade. Granted success there, we were to drive in from Mayflower portal, the only reasonable operating base on the whole length of the property. The deep and precipitous-walled gorge of Cunningham Gulch was the forbidding approach to the Shenandoah-Dives portal at 12,100 ft. altitude. The new portal of the Mayflower, at 11,100 ft., is the one safe spot on the wall of Arrastra Gulch. Prospects for large production, even if we were limited to the first 1,000 ft. from the surface, justified planning a long drift into the heart of the mountain with a single 2,000-ft. operating shaft to be raised to surface to serve the whole mine. A two-mile cable tramway would reach a good mill site in the canyon of the Animas.

Development at Mayflower began in October, 1926, and has been continuous since that time. A new crosscut, 225 ft. long, intercepted the old intermediate level. It was chosen as the main operating level because a high cliff at the portal offered security for the mine house. Drifting was carried on from the old low-grade breast, with indifferent results until August, 1927, when, midway in the Slide claim, excellent ore was found, which continued with little interruption to the end-line of the claim. Early in 1928, as a result of the success in opening orebodies, the plan for the major workings connecting Shenandoah-Dives and North Star to the surface was postponed in favor of developing the Slide and Mayflower claims for early production. At this time, we secured a sublease on the old mill of Iowa Gold Mining & Milling. It was an old gravity concentrator and was sadly inefficient with our ore. Within the old shell, in parallel with the old plant, we set a modern milling unit of 100-ton daily capacity, which treated ore by ball-mill grinding, with gravity and flotation concentration. The new plant went into regular operation late in June and has operated at full time since then. Most of the tonnage of metal-bearing production has come from development. The enterprise has been more than self-sustaining from that production. We apparently have justified our belief in ore at depth.

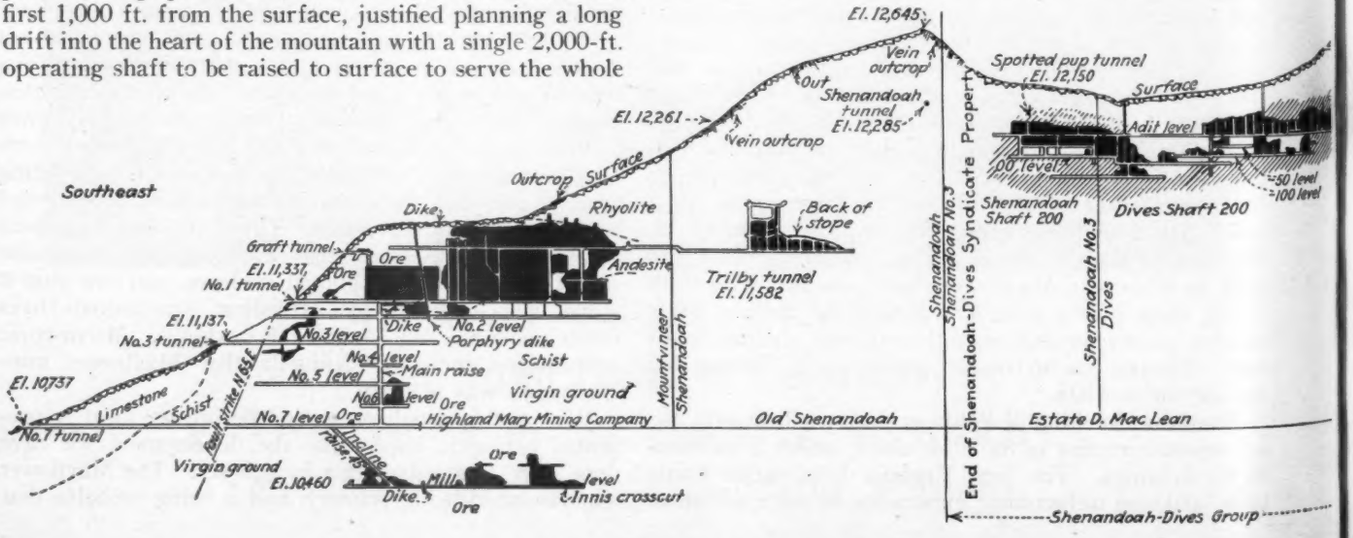
In April of this year, to make the most of the summer season for construction work, the Syndicate—the informal organization which had developed the project—organized the new corporation and offered an issue of securities to bring the total outstanding to $414,000 of 7 per cent five-year bonds, of a total authorization of $500,000; and 3,283,000 shares of $1 common stock, of a total authorization of $3,500,000. This financing is now complete.

Present financial requirements are $699,000, the principal items therein being:

Mine equipment and crushers	$80,000
Mine house and offices	40,000
Cable tramway	85,000
Mill and adjacent structures	375,000
Working fund	50,000

As special warrant for this large investment we made these representations:

1. We had effected large-scale sampling by the ten months of profitable operation. The ore of the period



averaged 0.32 oz. gold and 5 oz. silver to the ton, with 0.7 per cent lead and 1.4 per cent copper. Having come largely from development, the figures provide a basis for appraisal of a large tonnage.

2. We had shown proved and probable ore in narrowly limited areas of a net value of $1,200,000.

3. Unusually secure assurance is offered for large future production in this evidence: (*a*) The outcrop of the Terrible claim almost throughout its length shows good widths of good ore. (*b*) The Shenandoah-Dives levels, with their extensions into North Star, offer proof of the vein at moderate depth. (*c*) The Mayflower-Slide workings are proof of mineralization at greater depth. (*d*) The excellent floor ore at Mayflower-Slide argues for great possible depth in the light of the depth at Highland Mary.

At Shenandoah-Dives the average width of ores in productive areas is over 5 ft., and it is over 6 ft. at Mayflower and Slide, so we assume half a ton of ore per square foot of hanging wall. Total hanging wall area unexplored above Mayflower main level is 10,000,000 sq.ft.

The sub-Arctic conditions of high-altitude San Juan operation are an old story to us, and the construction will be adapted to them. At the mine, transformers, shops, compressors, and crushers are all to be within the mountain. Living quarters on the surface have been planned along the lines presented in the recent excellent papers in *Engineering and Mining Journal* by Clement and Govan on housing in northern Ontario.

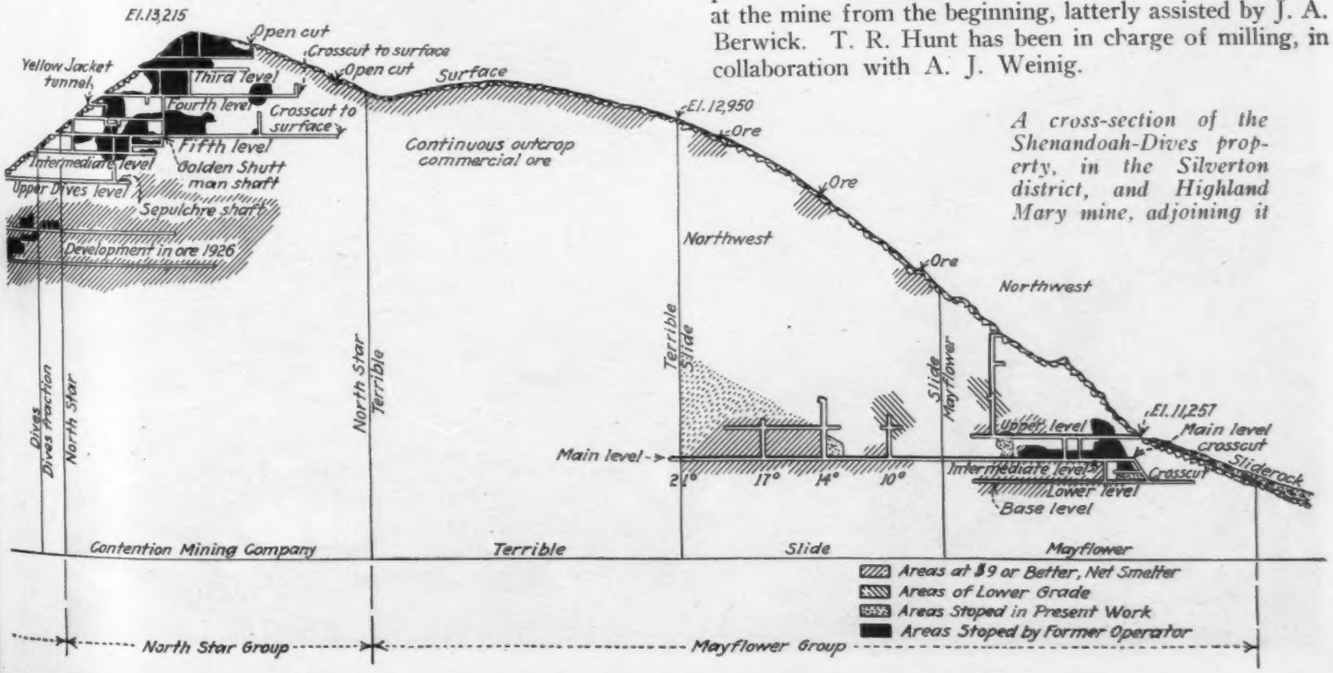
All of the mechanical plant is planned for minimum cost operation. Stope excavation is to be confined to the day shift, the heavy compressor load thus entailed being offset by two-stage crushing and haulage on the night shift. Track gage of 30 in. is to give stability to three-ton cars. Use of storage-battery locomotives will avoid trolley wires and track bonding. The cable tramway, 10,000 ft. in length, is being designed by Fred C. Carstarphen. Structures and cables are to be ample for 80 tons hourly, thus limiting operation to the day shift.

The mill was designed by Arthur J. Weinig, who has studied the ore throughout our development and has had the benefit of the pilot operation. Two-stage crushing at the mine permits the use of a single 86 Marcy mill for

View from the mill terminal of the tramway up the gulch to the portal of the Mayflower tunnel. Gash of vein seen in cliff, left of the upper terminal of the proposed tramway.

300 tons. Wilfley tables at two points in the mill will make lead concentrate which will be amalgamated for its gold. Flotation will make principally a 15-20 per cent copper froth, with some lead which may be amalgamated. A second froth of iron and copper will be reground and refloated for the copper. Mill heating will be from mill water flows, heated with the exhaust steam from a small turbine. This will furnish lights and limited power; major power requirements are met by the Western Colorado Power Company. Tailing will be drawn from a 50-ft. thickener and the decanted warm water returned. The mill building for wo 300-ton units and equipment for the first of these units are already under construction by Stearns-Roger Manufacturing Company. The contract calls for operation in November next.

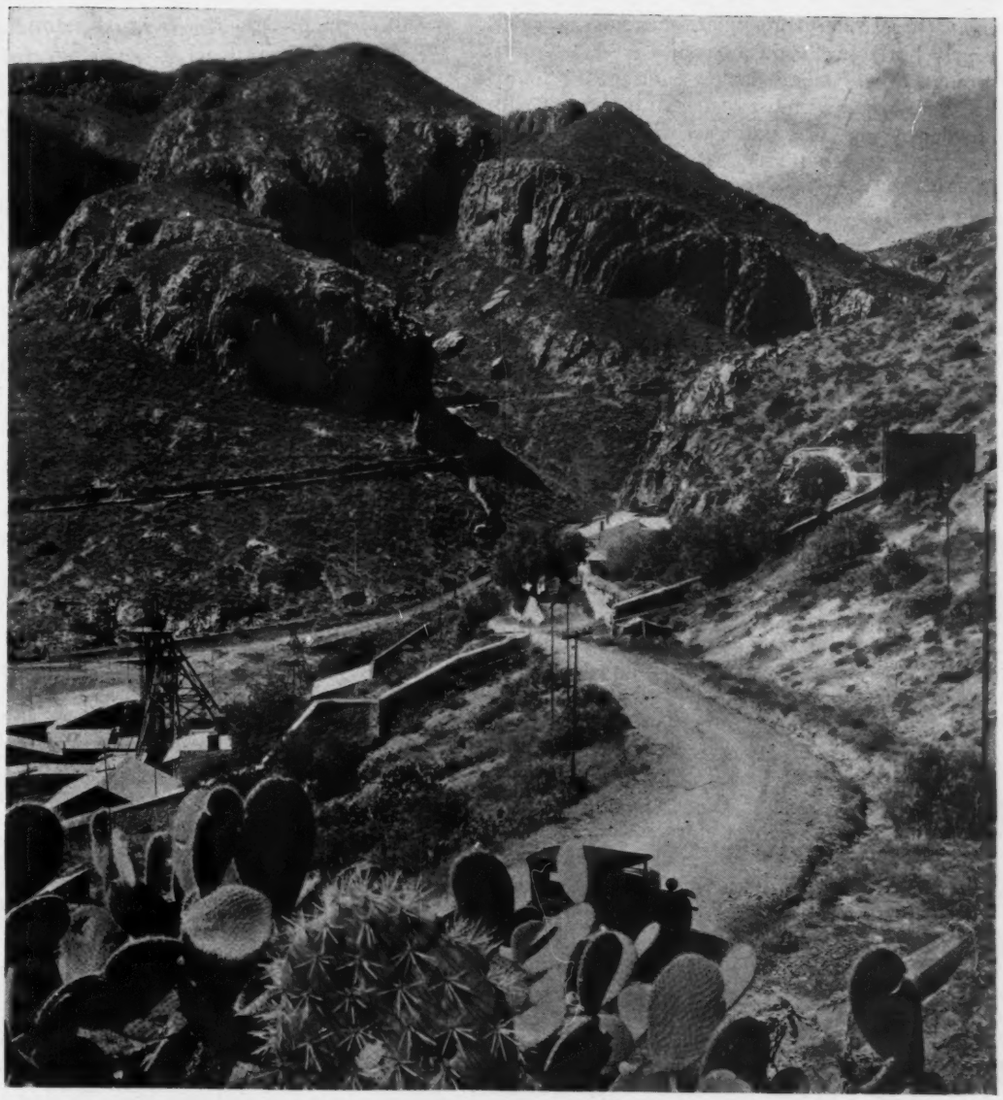
Orville R. Whitaker was called in consultation on October, 1926, and gave hearty approval to the project. James W. Oldham, of Kansas City, and I undertook, respectively the financial and engineering burdens of the promotion. Locally, James A. McKay has been in charge at the mine from the beginning, latterly assisted by J. A. Berwick. T. R. Hunt has been in charge of milling, in collaboration with A. J. Weinig.



A cross-section of the Shenandoah-Dives property, in the Silverton district, and Highland Mary mine, adjoining it

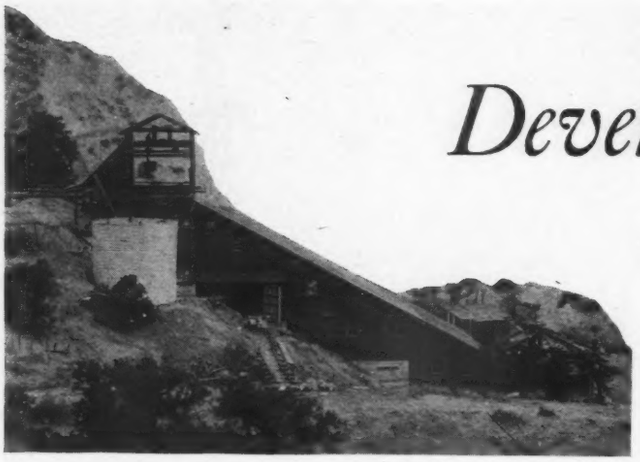
MEXICO— The Land of Tortillas and Frijoles — and MINES

Left: Villa San Pedro —a typical Mexican mining settlement. Below: Real del Monte, in the Pachuca district. The rope tramway carries ore from mine to plant.



Above: Unloading station of a 14,000-kilometer rope tramway. Right: Typical mountain roads in the heart of the Pachuca mining region.

Developing an Efficient



Mill of the Arlington Mining Corporation at Black Hawk Canyon, San Bernardino County, Calif.

AN INTERESTING AND SUGGESTIVE SUMMARY *of experiments and conclusions, untrammeled by prejudice in favor of schemes of treatment that might be considered more up to date. Metallurgical initiative and independent work of this character should lead to the exploitation of the many deposits of gold ore that are now considered valueless because of a general disinclination to break away, when occasion warrants, from accepted and successful practice elsewhere—to apply the it-can-be-done philosophy that promises so successful a result in the present instance.*

ARLINGTON MINING CORPORATION, operating in Black Hawk Canyon, San Bernardino County, Calif., recently completed a series of large-scale tests to determine the grade and behavior of an unusual type of ore, and to formulate a feasible and simple method of treatment. The ore is a slightly siliceous limestone, somewhat changed to calcite, resting nearly horizontally on a granite base, no piece of ore as broken down being large enough to require a rock breaker. In fact, most of it can be broken down without powder. The ore outcrops from 50 to 300 ft. thick (wide). In character, it may be divided into three classes: *A*—a mass of millions of tons of low-grade ore, which, by screening to ¼ mesh, concentrates 80 per cent of the gold in the fines. This mass contains native mercury in appreciable quantities, with no cinnabar so far discovered, and molybdate of lead as an associated mineral. *B*—a mass of easily broken ore in which the gold is in the plus ½ mesh to the extent of 81 per cent, but no mercury apparent. *C*—veins or mineralized zones wherein the gold is evenly distributed in the ore, so that all must be ground to free the metallic contents.

Gold, the only metal of commercial value in these ores, assays $1.80 to $14.00 a ton in milling volumes, although at times streaks are found containing $1,000 or more per ton. Silver in the bullion amounts to 1/160th the value of the gold. In the cyanide precipitate it is nearly 1/100th.

All machinery in the mill is standard. We start with a self-feeder (no rock breaker); then a ball mill with a 30-mesh screen; classifier; copper plates 4 ft. wide and 15 ft. long, electroplated with 2 oz. silver to the square foot; two concentrators; mercury traps; three thickeners; three Pachuca agitators with air lifts; vacuum filter; two four-ton sand tanks with canvas filter bottoms; and zinc boxes. Power is supplied by Fairbanks-Morse *Y* semi-Diesel engines.

Mercury had not been found in these ores previous to the start of milling operations. The first experiment was to grind and amalgamate 64 tons of crude ore without any cyanide treatment. The recovery was 36 per cent. Tears of mercury appeared on the plates in excess of that possible from the amount used in dressing. Many samples of ore were panned, in some instances showing native mercury, particularly in the hard pieces, indicating the necessity for a screening operation.

Next, 465 tons of ore was screened to ¾-in. mesh and the undersize was ground to 30 mesh and amalgamated without cyanide treatment. Screening ratio was 2.6 to 1. The reject went 40c. per ton. Recovery was 24 per cent. Mercury went into the tailing as formerly. Then, 617 tons was mined and screened to ¼ mesh, 170 tons being milled. Ratio of concentration was 3.6 to 1, with 80 per cent of the gold in the screenings. The fines were ground to 30 mesh and amalgamated without cyanide treatment. Recovery was 24 per cent. Later, 200 tons was mined, screened to ¼ mesh, ground to 30 mesh, amalgamated and cyanided in the counter-current system to be later described, but with no better result in recovery.

The mill was run on the day shift only. The steel wire screen clogged so from rust and particles of ore that the screening efficiency was low. A brass wire screen was substituted, which does not rust nor readily clog, and lasts four to five times as long as the steel wire screen. The concentrators took the discharge from the plates in these tests, but the gold content of the concentrate was never high enough to warrant shipping. Cast-iron balls were recommended for milling, but we soon changed to forged-steel balls.

To determine if it was possible to catch the mercury and gold by means other than plates—namely, concentrators and cyanide—the mill was rearranged with a centrifugal separator, settler, and Nome riffles in circuit as shown in Fig. 1. With this new arrangement numerous tests were made, but with no better results: the tailing continued to contain mercury in excess of that used in the milling operations. In other words, the mercury in the ore would not coalesce with the mer-

and Economical Gold-Ore Treatment Process

By Algernon DelMar
Metallurgist, Los Angeles, Calif.

cury in the separator or traps. We therefore concluded that, when ground wet, an amalgam was formed that would not amalgamate, remain in the traps, or be soluble in cyanide solution.

Four one-ton lots of minus-¼-mesh screened ore (without grinding) were cyanided in sand tanks with a potassium cyanide solution (2½ lb. KCN to the ton). Tests showed that extraction increased with the duration of contact: an 86 per cent recovery was made in 96 hours, and 92 per cent in 110 hours. As 80 per cent of the original gold was retained in the minus-¼-mesh screening, the final extraction was 74 per cent of the original content. This did not appear efficient at first sight, but as the screening eliminated 2.6 tons of 40c. ore to the one ton treated, we avoided the cyanide treatment of this 2.6 tons, the net result being a low-grade ore treatable at a profit by this method. High recovery does not necessarily mean economy. The mercury was disregarded.

Now that we had solved the treatment for the type *A* (mercurial) ores, we next mined and conveyed to the mill 45 tons of Type *C* ore. As the gold was not concentrated in the fines, it all had to be ground fine enough to free the metallic particles. A recovery of 70 per cent was made on plates, the concentrate, as before, being of a grade not suitable for shipping. As the tailing averaged about $5.50 per ton, a cyanide process was indicated. Many bottle tests of the tailing showed a high extraction with weak cyanide solution.

The next series of tests was made on 2,200 tons of ore, part of which was obtained by selective mining. The final outcome led to the reconstruction of the mill as indicated by the flow sheet shown in Fig. 2. The

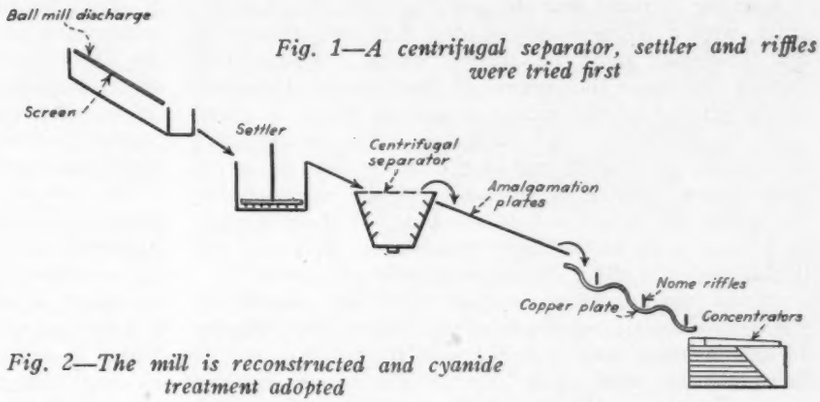


Fig. 1—A centrifugal separator, settler and riffles were tried first

Fig. 2—The mill is reconstructed and cyanide treatment adopted

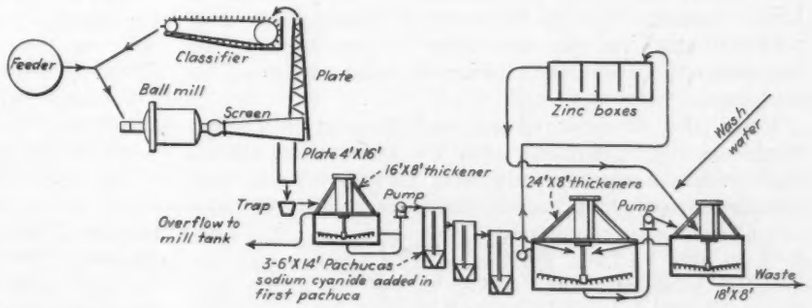


Fig. 3—Composite flow sheet for all types of the ore

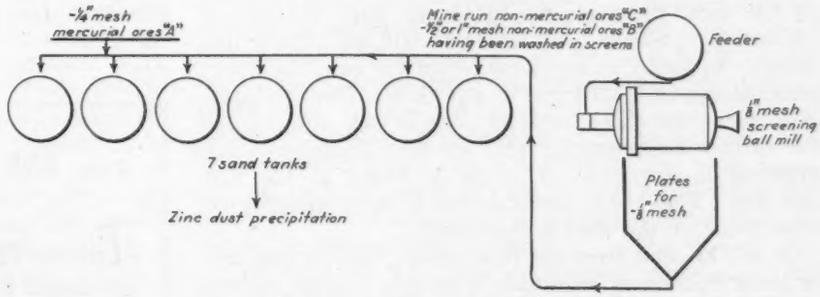
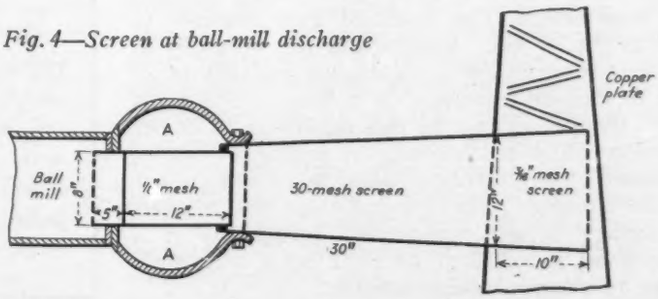

-¼" mesh mercurial ores "A"
Mine run non-mercurial ores "C"
-½" or 1" mesh non-mercurial ores "B" having been washed in screens
Feeder
1" & ⅛" mesh screening ball mill
7 sand tanks
Zinc dust precipitation
Plates for -⅛" mesh

Fig. 4—Screen at ball-mill discharge



reason why a 30-mesh screen was selected is because at that mesh we reached the ultimate coarseness at which this ore could be treated in thickeners and Pachuca agitators. In fact, we have no record of this having been attempted before. Tests showed that the extraction on $\frac{1}{8}$-mesh product was as good as on the 30 mesh.

The amalgamation plate has strips of belting, for riffles, bolted to it. Behind each riffle a plating of amalgam collects about 1 in. wide. The concentrators were discarded, with no bad effect on the cyanide solution. The filter was also discarded, although half the gold in the tailing is dissolved. Some of this could be saved; but, as the tailing is low in value, a filter is not justified.

Keeping in mind that the grinding mill runs but one shift, with a 30-mesh screen, and that both thickeners and Pachucas must be started every morning, two factors determine the success of this process: the mesh of the screen and the means of getting rid of the sand from the thickeners and Pachucas. After the ball mill is stopped, the cyanide end of the mill is kept going for three hours; then it is stopped, and the rakes on the thickeners are raised out of the mud. If the Pachucas have been kept at the right consistency, they and the thickeners start off in the morning without trouble.

When grinding to 40 mesh or finer, the capacity of the unit was reduced, the ore was slimed, the capacity of the thickener was curtailed, and the settling was so slow that the mill could not be shut down in any reasonable time. We found that cyanide solution of 1.5 lb. potassium cyanide to the ton dissolved the gold so readily that there was no reason to grind finer than necessary to work the thickeners and agitators to advantage.

Using the 30-mesh screen, the sand at first gave trouble in the thickeners, until we found that a thick outflow was necessary, otherwise the sand would not remain in suspension, but settled out in the underflow pipe and closed it completely. Then we had trouble with sand in the Pachuca agitators. The sand would accumulate while the slime flowed to the succeeding agitator. To remedy this we constructed a box around the top of the lift pipe with a movable swinging launder leading to the next agitator. If the launder is fixed at the exit, the tank would empty until the critical hydrostatic pressure was reached; but, by causing the launder to swing to and away from the exit, the heavy material can be discharged at any time. The procedure is to swing the three launders (one in each agitator) to the exits when pumping from the first thickener. The grinding is in water. Cyanide is added at the first agitator. The ore is neutral, but a small quantity of lime (4 oz. to the ton) is necessary.

It will be seen from the flow sheet (Fig. 2) that two or three thickeners, as usually seen in a counter-current cyanide system, are missing, but, as this is only an experimental plant, the loss to be attributed to this omission can be determined. The dissolved gold amounts to from 12 to 20c. a ton. Results attained were 69½ to 72½ per cent recovery by amalgamation and 18½ to 22 per cent by cyanide treatment, or a total of 91½ to 94 per cent. By the addition of two thickeners, a 97 per cent recovery could be obtained. A milling process is never finished: losses can be lessened and complications have to be obviated. For low-grade ore the counter-current system is too complicated, particularly if a simpler process is indicated by tests on a sufficiently large scale to prevent miscalculations.

Test on the Type *B* screening ores showed 81 per cent concentration, with wet screening to $\frac{1}{2}$ mesh, the gold being readily soluble in weak cyanide solution after amalgamation when ground to 1.8 mesh. Combining all the factors, we have an ore that cannot be ground wet before cyanide treatment but which can be cyanided when screened to $\frac{1}{4}$ mesh. Then, an ore that must be all ground, but which is susceptible to cyanide treatment after an amalgamation when coarsely ground. Next, an ore that can be economically screened to $\frac{1}{2}$ mesh and cyanided after amalgamation when ground to $\frac{1}{8}$ mesh. Fig. 3 shows the composite mill to treat all these ores. The minus-$\frac{1}{4}$-mesh Type *A* ores go direct to the sand vats without grinding. The $\frac{1}{2}$-mesh Type *B* ores and the Type *C* ores are ground to $\frac{1}{8}$ mesh, amalgamated to remove the coarse gold, and then join the Type *A* ores in the sand tanks. In this mill there is no complicated machinery. Coarse grinding is economical, and the tanks are filled automatically and emptied by power machinery, or, if the percolation is sufficiently rapid, high tanks may be used and emptied at small cost.

The screen on the ball-mill discharge may be of interest to mill men; it is shown in Fig. 4. The enlargement at the mill exit is an amalgamator with a copper plate surrounding the screen discharge, which is not shown in the sketch. This amalgamator is supposed to take care of the minus-$\frac{1}{8}$-mesh material, but we discarded it as being of no value. The screen at the far end separates the minus-$\frac{3}{16}$ from the plus-$\frac{3}{16}$-mesh material, both amalgamating on a copper plate leading to the classifier. The object is to prevent the plus-$\frac{3}{16}$ from scouring the minus-$\frac{3}{16}$ plating. It works well. This 30x37-in. screen gives as much screening area as three to five stamp batteries. A water spray extends the full length into the screen, the water being regulated to the needs of the plates.

We tried amalgamating inside the ball mill, but could see no advantage, particularly as the amalgam formed in the mill was recoverable only at considerable expense. We later tried to keep mercury from entering the ball mill, by means of the copper plate already described, and also placed a copper plate at the discharge end of the classifier. We have no difficulty in amalgamating coarsely ground ore if the riffles are bolted to the plates; otherwise a scouring action is noticeable.

The Latest in Quicksilver Metallurgy

THE FUTURE of the domestic quicksilver industry will depend to a considerable extent on the development of an efficient and economical metallurgical technique. In a forthcoming issue of Engineering and Mining Journal will appear an article by Mr. W. G. Adamson, general manager for the Pershing Quicksilver Company, operating at Lovelock, Nev., who will describe the progress made at that property, with particular reference to the furnacing of the ore in Herreshoff units, the collection of dust, and condensation. The account will prove highly informative, and stimulative of further progress elsewhere.

Scientific Management in Mining—II

THE results of time and mechanical studies suggest such betterments in the co-ordination of the work, and in the application of labor, materials, and equipment, that standard methods of conducting particular operations may be formulated and introduced. The standardization of drilling rounds for underground headings of given dimensions in given ground is accepted practice on some mines in America, Mexico, South Africa, and Germany. The proper number, depth, and direction of the holes, the proper explosive allowance, and procedure in firing are determined from tests and studies, and the work is done according to printed and drawn instructions.[1]

Ordinary stoping does not offer the same opportunity for standardization. Nevertheless, in South Africa some measure of uniformity in stope drilling is obtained with the help of a "hole director."[2] Further, where mining by inclined-raise caving was practiced in the southwest copper belt of the United States, it was sometimes possible to divide the work of bringing a block to full production into a number of successive stages, each of which could be standardized with advantage.

Instruction of Labor—From standardization, which connotes the issuing of instructions in methods and operations, the instruction, in the artisan tasks of mining, of recruits who are as yet unfamiliar with mining or are young enough to learn is a natural step. The instruction here envisaged is that to be given by a specially appointed skilled miner in a selected working place underground. In the coal and metal mines of the Phelps Dodge Corporation, such underground schools were instituted to overcome a temporary shortage of experienced miners. In these schools the newcomers were taken through a complete plan of instruction on simple practical points, the result being that the men who, after completing such instruction, remained with the company, proved themselves better at their work than the ordinary experienced miner. One or two months of such personal instruction sufficed to bring the men to such a standard that they could thenceforth be trusted to take part either in standardized work to printed and drawn instructions or in independent work. Similar definite instruction not only on strictly mining points but on the use and handling of mining machines is also commonly practiced in German mines.

Standards of Performance—Time and mechanical studies conducted on the lines indicated permit as one of their end results the determination of standard performances as bases for contract and bonus payments. Such standards should be set within what the studies show an average man working at a normal rate under the rearranged conditions can perform, allowing for reasonable rest periods and for unavoidable delays. Payment for performance in excess of these standards should be at a rate providing incentive to the men, while lowering the average cost of the whole operation.

Standards set on any other bases, whether on previous best record or on an ordinary try-out, or on a foreman's estimate, are never fair to both parties. Generally, the foreman puts the amount of work which should be done at too low a figure. Moreover, when standards have been set empirically, as in either of the above ways, some men in the event will prove to have been lucky in the terms granted to them, whereas others will prove to have been unlucky, with consequent discontent and charges of favoritism.

Planning in Advance—Careful studies also make it possible to construct in advance a detailed plan of work for the whole mine and for the individual sections; in special cases, for years ahead. Such planning should not only be for output but for operating costs and for equipment expenditure. Whatever the scope of the plan, when once adopted it provides for the members of the ordinary executive staff in their turn the standard performances which they should endeavor to attain, and at the same time furnishes bases for the payment of premiums to foremen according to the measure of their several attainments. It is here that the important questions of the further mechanization and of the closer concentration of the work find place for consideration.

Study Department: Personnel and Service—At a mine the ordinary executive officers are too engrossed with the routine duties of supervision for their thoughts to range in search of new ideas or their activities to include the initiation of radical betterments. As in factories, efficiency engineering in its completeness requires a separate staff devoted entirely to this particular work. This staff need not be large, but it should be of men specially fitted by their training to observe, digest, and analyze the abundance of data. If the directing organization includes a consulting engineer, the efficiency staff should report directly to him, while holding all their information also at the disposal of the manager. For a smaller mine, a single engineer reporting to the manager might suffice.

The work of the study department, outlined in the foregoing paragraph, demands impartiality, because in that spirit only can it be entrusted with the important function of calculating and determining standards. Possessed of the confidence of management and labor alike, the personnel of the department will have many opportunities of being of direct assistance to foreman and men, without waiting for their good service to be manifested only through the management. There will be times, also, when, after a project for betterment has been adopted by the management, the efficiency staff will be directly entrusted with its introduction, though more generally such introduction will be by co-operation with the executive staff.

The second and final abstract installment of the address of the retiring president of the Institution of Mining and Metallurgy, Prof. S. J. Truscott, delivered at the thirty-eighth annual general meeting. The first installment appeared in the issue of July 27.

[1]Barkdoll: *Eng. & Min. Jour.*, Oct. 27, 1926.

[2]Cullen and Ronaldson: *Trans.* I.M.M., Vol. 35, 1926.

Table V—Performance Report

Month..... District..... Foreman.....

Working Place	Duration of Work	Labor Employed per Day							Tonnage per day	Performance per Man-shift	Contract Price	Stores Consumed				
		Working Place		Along Roads				Total								
	From To	Face	Misc.	Development	Repair	Tramming	Misc.									
Totals.....																
Planned Performance..																

To the study department also the work of apportioning the costs of such distributive items as power, compressed air, and workshop expenditure may be rationally committed, because in itself it is not a spending department, and in this matter therefore can equally be expected to be impartial.

Occasionally, in the United States and Mexico, specialists in efficiency engineering have been commissioned to make complete investigations and to remain until their recommendations have been introduced. For a metal mine with an output of 1,000 tons per day, such a specialist with perhaps four assistant engineers and a clerk or two should complete such a survey, including that pertaining to any surface operations, in about a year.

At large American mines, it is more usual to select the necessary men from the routine staff. Probably the investigation would then be spread over a longer period, and the introduction of scientific management would take approximately two years.

Supervision embraces the work of officials necessary for the giving of orders, for discipline, setting the work, certifying the work done, restoring derangements, observing regulations, and reporting performances. The mine is divided into working districts and other suitable divisions, each in charge of a foreman. Above the foreman may stand an under-manager in charge of a section consisting of a number of districts. The mine manager is in charge of the whole mine workings under a general manager.

All these officials draw up their respective reports. Each working district should be the subject for a tabulated statistical performance report, having columns for the main classes of labor for each principal item of stores, for performances per shift, and for tonnage produced (Table V). The headings in these reports should suggest the titles for appropriate accounts in the detailed bookkeeping, the statistics themselves being useful data for the ascertainment of facts. From these reports and from the books, cost reports may readily be drawn up (Table VI). On each report the planned performance and cost respectively should be entered, so that quick comparison is possible between actual and expected results. This comparison will indicate the degree of smooth or deranged working. Derangement is thereby detected at its source, and its discovery by the management does not have to wait until it has reacted further down the line.

Whether the reports are daily, weekly, or monthly will depend upon the regularity of the items reported. Labor employed and tonnage produced would be items for daily report. Materials would be more rationally reported monthly, as the daily variations in consumption are too great.

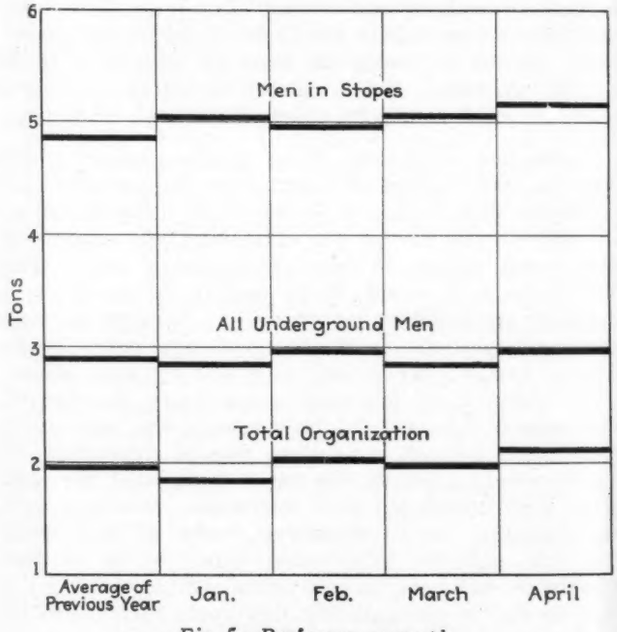


Fig. 5—Performance graph

Table VI—Cost Report

Month..... District..... Foreman.....

	Expenditure		Proceeds		Derangements	
	Actual	Planned	Actual	Planned	Duration	Cause
Labor: Class.....						
.....						
.....						
Materials						
.....						
.....						
Machines						
.....						
.....						

The under-manager in turn will complete reports in which individual districts are the units; and so on upward.

The mine manager will further keep separate items such as winning, development, and maintenance, so that the general manager may see to what extent all branches of the work have received attention. He will report on the labor statistics and production. His monthly report would in addition give the cost of such materials and of such distributive items as power, compressed air, and workshop expenditure.

All these numerous essential figures are finally summarized and analyzed by the general manager, who is then in a position to issue a summarized report giving total and unit performances and costs throughout. (Table VII.) Here again, graphs may be used to advantage. Plotted month by month upon a continuous chart of co-ordinate paper, a most convincing and instructive picture of the course of performance is given; irregularities are strikingly disclosed, as also is any regular trend toward betterment or worsening. (Fig. 5.) In the United States this particular representation is much used, every single item of help to supervision being charted, each in its related context.

So much depends on development that sometimes this branch of the work is singled out for special display on a progress chart, where the work performed up to a given time is shown graphically alongside that which was expected to be performed up to the same date, any retardation or acceleration of the program being plain for all to see. (Fig. 6.) This particular type of chart, known as a Gantt chart, from the name of its designer, may, of course, be used equally well to display the progress of production from particular districts.

Though inspection is included under supervision, it deserves special mention, because its incidence is on work done and not on work being done. How important and effective inspection may be was well shown by Newhall and Pryce, who, in their investigation into drilling on the Rand, found that though a definite heat treatment for the borers had been prescribed, an inspection of blunt bits disclosed that 30 per cent were being faultily treated, a figure which by daily routine inspection was brought down to 7.5 per cent in a week, with readily conceivable advantage to drilling. (Fig. 7.)

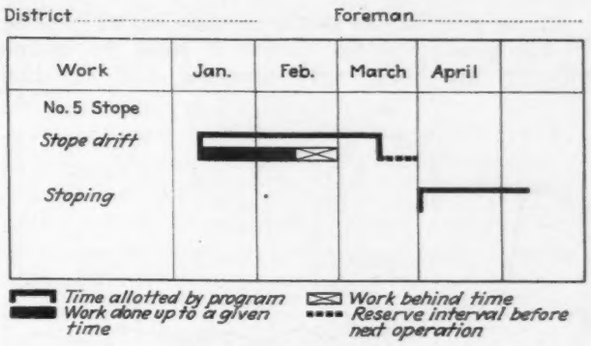


Fig. 6—Progress chart

Close supervision, even without any explicit efficiency engineering, undoubtedly provides of itself data and comparisons on which rearrangements leading to economy can be based. The primary work of this supervision is, however, rather to keep things going smoothly and satisfactorily, and the betterments achieved are only incidental to this work. No one is specifically charged with the attainment of efficiency. Under scientific management, though there will always be a merging of

Table VII—Typical Performance Report

The records of unit production by the Bunker Hill & Sullivan Mining & Concentrating Company, Kellogg, Idaho, for 1922, are based upon a production of 421,532 tons of ore. The following are the more important unit records:

(1) All men in stopes: man-hours, 792,642; tons, 419,533; 0.529 tons per man per hour, or 1.889 man-hours per ton.

(2) Man-hours on development in ore, 35,048; tons ore, 19,999; 0.57 tons per man per hour; 1.752 man-hours per ton.

(3) Man-hours on development in rock, 5,232; tons rock, 1,593; 0.304 tons per man per hour; 3.289 man-hours per ton of rock.

(4) Man-hours for all miners, 252,968; tons produced, 421,532; 1.666 tons per man per hour; 0.60 man-hours per ton.

(5) Man-hours for all underground labor, 948,000; tons produced, 421,532; 0.444 tons per man per hour; 2.248 man-hours per ton.

(6) Man-hours for surface labor, exclusive of office, 155,960; tonnage, 421,532; 2.702 tons per man per hour; 0.369 man-hours per ton.

(7) Man-hours for total organization, including office, 1,175,960; tonnage, 421,532; 0.358 tons per man per hour; 2.789 man-hours per ton.

(8) Percentage of mine labor on basis of total man-hours, 80.6 per cent; surface, including office, 19.4 per cent.

(9) Labor turnover amounted to 567 men in the year for an average of 435 employed.

(10) Total labor cost was $514,500.09; total cost of mining, $1,180,693.31; labor equaled 43.5 per cent of total mining cost.

(11) Mining supplies totaled 239,250 lb. explosives; 1,404 boxes caps; 154 cases (924,000 ft.) fuse; ratios per ton were 0.567 lb. powder, 0.0033 boxes caps, and 2.192 ft. fuse. Timber totaled 6,435,980 bd.ft., or 15.26 bd.ft. per ton.

(12) Yearly horsepower-hours totaled 18,790,071; ratio to ore tonnage equaled 44.5 hp.-hr. per ton, 0.005 hp. per ton; total horsepower equaled 2,145; for compressed air, 12.8 hp.-hr. per ton; haulage, 2.7 hp.-hr. per ton; hoisting, 17.1 hp.-hr. per ton; pumping, 383 hp.; ventilation, 116.34 hp.; lighting, 1.5 hp.-hr. per ton. The distribution of power was: total 2,145 hp. divided into compressed air, 618.4 hp.; haulage, 130 hp.; hoisting, 824 hp.; pumping, 383 hp.; ventilation, 116.34 hp.; lighting, 73.48 hp. Compressed air equaled 64.235 cu.ft. per ton.

(13) Total cost of mining supplies was $229,361.41, or 19.4 per cent of total mining cost. Illuminants cost $3,869.12 and miscellaneous supplies $66,447.20, or a total of $70,311.32.

the two departments, supervision is directly charged with the endeavor to obtain the planned performance accepted by the management from the carefully checked and confirmed ascertainments of the efficiency engineering department. Under such conditions the work of supervision is more straightforward and, consequently, results are more satisfactory.

The Human Factor

Management has not only a technique but a psychology. If management is to succeed it must be accepted willingly, and must carry everyone with it. Body,

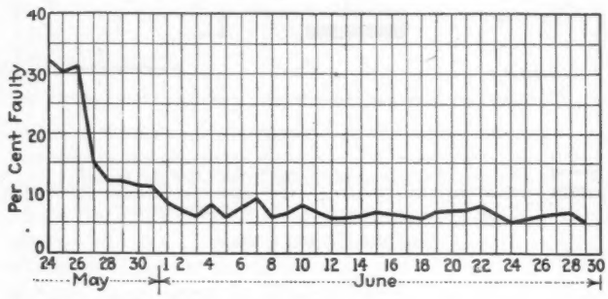


Fig. 7—Percentage of faulty bits, as determined from daily inspection of used drills

intellect, and will must all be engaged, and of these the will is the most essential.

Labor must be assured that the management has the welfare of the men at heart and is sincere in its protestations of interest in them. The men must also be assured of the capacity and superiority of the officials over them, and of the management as a whole. These imponderables are all the more necessary when changes such as those which may accompany scientific management are being introduced. But if a plan has been well thought out and bears evidence of this in its application, the men will respond. The first necessity is frankness. All questions should be frankly answered and all intentions should be frankly explained. The fallacy that these investigations are some sort of driving should be faced and disproved.

Community of Interest Should Be Demonstrated

At the outset the promise that the new methods will benefit the men as well as the management should be sustained by some useful service such as removing obviously bad working conditions or improving the condition of tools and machines. Subsequently, information regarding costs should be freely issued. Details and results of all contracts should be posted openly, that all interested may become familiar with such factors of routine operation.

It will be interesting here to compare or contrast the methods which have been successful in achieving labor efficiency in industry. Taylor regarded the man as a machine to do a mechanical task, and his aim was to perfect that machine. Ford regarded the man as an attendant upon machines; he relied upon perfect layout and uninterrupted circulation of the work. What was required of the man was to be alert; no great physical effort was required and no fatigue was involved. Under both procedures rhythm was a feature, and all hindrances to regularity were removed. Rhythm in work appeals to all workers; it gets the work swinging, and there is irritation when the rhythm is broken. Apart from this appeal the men under Taylor were paid promptly and well for any performance beyond the standard. The men at the Ford plants are paid day wages and none work under contract payment; the rate of wages is, however, the high one which the great efficiency of the system allows; as in all mass production, the system follows the maxim—one man, one job.

In mining, owing to the complexity of the work, neither of these two systems is directly applicable. But in the large use of machines, and in the fact that greater economies are possible in the layout and load factors than in the perfection of men in physical tasks, the methods of Ford come closer to applicability than those of Taylor, the latter being applicable only in the appeal which can be made by contract and bonus payments for extra performances. General amenities external to the actual work conduce to contentment. But the greatest satisfaction outside of good earnings comes when the men can feel, as they can under an efficient management, that they are doing good work and are thereby of service to the community. Management must take the view that stable success cannot be obtained unless its methods and intentions have an ethical basis. Subject to that, management must be decided, determined, and energetic. Once any particular change has been decided on by the directors, it should be forwarded relentlessly, bearing down any opposition.

The need for scientific management in mining lies chiefly in the fact that without time studies the actual losses of time are unknown and their large total amount is unsuspected; accordingly, the practical man's empirical estimate of what constitutes an efficient performance is always too low. To drive the men to greater effort in order to make good a performance which is low primarily for lack in organization is unjustifiable and impracticable. Yet better performance there must be. There remains only scientific management.

Objective Study and Analysis Essential

Under scientific management all possible routine operations are studied objectively, analyzed, and digested, leaving as little as possible to subjective estimation, the purpose and the result being to make the best possible use of labor, materials, and equipment. Under it, the men at no greater effort achieve a better performance, and for any extra effort beyond a carefully ascertained standard there is the incentive of extra payment.

Scientific management has its justification in the fact that all records of high efficiency have been made when foremen and men were working to a plan carefully worked out in detail by the management. It raises the standard all round, it brings greater production and lower cost, and higher earnings for the men employed.

Justification for the use of the term "scientific" is found in the fact that the management which has here been outlined proceeds first by careful observations, then to logically deduced conclusions, before final effect is given. If any further justification were needed, it would be found in the following words from a lecture on "Science and Culture" by Huxley:

"They (the capitalist and the operative) must learn that social phenomena are as much the expression of natural laws as any others; that no social arrangements can be permanent unless they harmonize with the requirements of social statics and dynamics; and that, in the nature of things there is an Arbiter whose decisions execute themselves."

COMMENT AND CRITICISM

Effect of Iron Contamination on Extraction and Cyanide Consumption After Super-Fine Grinding

To the Editor of "E.&M.J.":

I suppose it has been generally recognized for many years that in fine grinding of ores for cyanidation a tendency to increased consumption of cyanide might be expected when using iron surfaces in whole or in part in the milling equipment. I have, however, never read any account of attempts to estimate the extent of that tendency, and have myself, until quite recently, been inclined to consider it not sufficiently important to enter into practical considerations. It is still possible that it may be unimportant in the case of the average "all-sliming" mill for treating general mine ore, where the degree of comminution found to be most profitable is such that 70 to 80 per cent will pass a 200-mesh sieve; but in the cyanidation of mill concentrate, where it is necessary to grind very much finer than 200 mesh, and where the degree of comminution seems in some instances to be almost a direct measure of the extraction to be obtained, the effects of the detrital iron formed in grinding seem likely to possess more than a merely academic interest. In support of this proposition I offer the following figures, hoping that other workers may come forward and gave us the benefit of their experience along similar lines.

There are indications that not only may cyanide consumption be affected adversely by the presence of this extremely finely divided iron, but in some cases extraction also. I have therefore added the residue assay to the figures for each of the tests described. My interest in this matter was aroused almost by accident about a year ago, and I at once set about trying to find out whether my theory had any foundation in fact.

For laboratory work I have been in the habit of using a small iron pebble mill 7½ in. x 7½ in. inside measurement, capable of being tightly closed with a screw at each end, and charged about half full with small flints. The mill receives a suitable charge of ore and water, usually 500 grams of ore and 400 c.c. of water, and is rotated by being laid on a pair of revolving wooden rollers. For purposes of my comparison, I had one of these mills lined with inner-tube rubber, both periphery and ends, and ran the two against each other on portions of the same ore sample, using flint pebbles in both mills. Grinding was in every test done in water and not cyanide solution.

(Note: Concentrates with different letterings represent lots from different localities often widely separated. Tests made on concentrates having the same lettering represent different lots from the same mine.)

Test No. 1
Concentrate *A*
Head Assay Value, Gold in Dollars
118.83

This concentrate was ground for two hours and subsequently agitated in cyanide solution for 48 hours. Cyanide strength aimed at throughout treatment was 0.15 per cent potassium cyanide. (Note: "Cyanide strength aimed at" was never maintained through the whole period of treatment, though solutions were made up to strength twice the first day and again at the beginning of the second day.)

	Consumption, Pounds per Ton NaCN	CaO	Residue Assay Value, Gold in Dollars
(*a*) Iron-lined mill ..	22.7	20	7.85
(*b*) Rubber-lined mill	10.6	12	5.92

Test No. 2
Concentrate *B*
Head Assay Value, Gold in Dollars
55.71

Treatment was the same as in test No. 1, but a 2½-hour grind was used.

	Consumption, Pounds per Ton NaCN	CaO	Residue Assay Value, Gold in Dollars
(*a*) Iron-lined mill ..	14.4	14	7.07
(*b*) Rubber-lined mill	5.7	13	4.75

Agitation for 48 hours in cyanide solution was employed. Cyanide strength aimed at during treatment was 0.15 per cent potassium cyanide.

Test No. 2 – *X*

In order to see whether the detrital iron could be rendered harmless by oxidation before adding cyanide, a duplicate portion was ground in the iron-lined mill and then subjected to violent agitation with compressed air for 24 hours. The pulp was then cyanided in the usual way.

	Consumption, Pounds per Ton NaCN	CaO	Residue Assay Value, Gold in Dollars
(*c*) Iron mill, with preliminary aeration.....	8.0	17	5.58

Comparing this with 2(a), a considerable improvement is shown both in cyanide consumption and extraction, but a slight rise in lime consumption is noted. It is possible that a 48-hour preliminary aeration might have produced results equal to those given by the rubber-lined mill 2(b), but the experiment was not tried.

Test No. 3
Concentrate *C*
(No head assay made)

The sample was taken from the return oversize to the tube mill in the grinding plant. It was given a two-hour grind in laboratory mills and agitated 48 hours in cyanide solution.

	Consumption, Pounds per Ton NaCN	Residue Assay Value, Gold in Dollars
(*a*) Iron-lined mill ..	14	5.37
(*b*) Rubber-lined mill	10	5.37

THE fine grinding of an ore with customary equipment involves an addition to the pulp of a considerable amount of finely divided iron. A cyanide engineer, whose contributions to practice and to the literature of the subject are well known to readers of *E.&M.J.*, makes pertinent comments based on experimental research and logical analysis. Mr. Hamilton's letter should evoke an interesting discussion on a probable cause of inefficiency.

Test No. 4
Concentrate *B*
Head Assay Value, Gold in Dollars 43.79

This sample was ground two hours in the laboratory mills and agitated 48 hours in cyanide solution.

	Consumption, Pounds per Ton NaCN	CaO	Residue Assay Value, Gold in Dollars
(*a*) Iron-lined mill ..	11.5	20	4.75
(*b*) Rubber-lined mill	4.1	16	4.34

Test No. 4 – X

Conditions were exactly as before with the exception that the head sample prior to grinding was in each case picked over with a horseshoe magnet to remove the more palpable iron particles derived from the battery. The iron thus removed was equal to 1.8 lb. per ton of concentrate.

	Consumption, Pounds per Ton NaCN	CaO	Residue Assay Value, Gold in Dollars
(*c*) Iron-lined mill ..	10.7	13	4.55
(*d*) Rubber-lined mill	4.3	12	4.45

The difference due to preliminary magnetizing seems too small to be significant of anything tangible, unless it could be confirmed by many parallel tests.

Test No. 5

At this point in the investigation it was first noticed that the physical appearance of the pebble-mill pulp suggested that for equal periods of grinding the rubber-lined mill had a lower grinding efficiency than the iron-lined mill. If this be true, and if extraction be proportional to the degree of comminution, then charges ground in the two mills for equal periods would not give comparable results as regards extraction, though it would seem fair to compare cyanide consumption in the main, while remembering that there is usually a tendency for consumption to increase somewhat with increased fineness of subdivision when dealing with sulphide concentrates. To try to compensate for this supposed difference in grinding efficiency between the two mills, the iron-mill charge was in the present test ground for two hours and the rubber-mill charge for three. This expedient is, however, of doubtful value, because, when grinding is carried beyond the point where the whole will pass a 325-mesh sieve, no convenient yardstick with which to estimate further comminution is available. Apart from grinding time the conditions of this test were identical with those that have gone before.

Test No. 5
Concentrate *B*
Head Assay Value, Gold in Dollars 41.11

	Consumption, Pounds per Ton NaCN	Residue Assay Value, Gold in Dollars
(*a*) Iron-lined mill; 2-hour grind ..	16.5	4.19
(*b*) Rubber-lined mill; 3-hour grind.....	6.4	3.51
(*c*) Rubber-lined mill; 3-hour grind, preliminary to magnetising; iron extracted = 1 lb. per ton of concentrate...	5.8	3.51

Test No. 6
Concentrate Residue

All but between 1 and 2 per cent of this material would pass a 325-mesh sieve, but a separation of "coarse" and "fine" was made by decantation and panning.

	Per Cent	Assay Value
Coarse.....	45.6	$5.79
Fine.....	54.4	4.75
	100.0	$5.22

The coarse material formed the subject of this test.

Assay Value, Gold in Dollars 5.79

	Consumption, Pounds per Ton NaCN	Final Assay Value, Gold in Dollars
(*a*) Ground in iron mill for 1½ hours.....	7.6	3.93
(*b*) Ground in rubber mill for 2 hours	3.7	4.13

Test No. 7
Concentrate *D*
Head Assay Value, Gold in Dollars 86.13

A two-hour grind was used and a cyanide agitation of 30 hours in each test.

	Consumption, Pounds per Ton NaCN	CaO	Residue Assay Value, Gold in Dollars
(*a*) Iron-lined mill ..	9.4	16	3.10
(*b*) Rubber-lined mill	3.3	12	2.58

Test No. 8
Highly Pyritic Mine Ore
Head Assay Value, Gold in Dollars 15.46

In this test, in addition to the regular comparison between iron- and rubber-lined mills, a second charge was ground in the iron mill under the following conditions: the charge was dumped every 15 min., the pebbles were washed off, and the pulp was screened on a 200-mesh sieve, only the oversize being returned to the mill for further grinding. The total grinding time thus consumed was 45 min., against two hours for the continuously ground charges. In terms of detrital iron formed, however, the 45 min. for the new charge was equivalent to considerably less time, because the grit returned for regrinding was a rapidly diminishing quantity, the amount returned and ground during the last 15 min. being probably not more than 10 per cent of the original 500 grams. Cyanidation was in each test for 48 hours. Cyanide strength aimed at throughout agitation was 0.2 per cent potassium cyanide.

	Consumption, Pounds per Ton NaCN	CaO	Residue Assay Value, Gold in Dollars
(*a*) Iron-lined mill; 2-hour grind ..	10.0	10	3.02
(*b*) Rubber-lined mill; 2-hour grind.....	4.6	8	3.02
(*c*) Iron-lined mill; minus 200 mesh; ¼-hour grind.....	5.2	8	3.02

This test is especially interesting because, although it consistently shows the wide difference in cyanide consumption between iron and rubber liners with exceedingly fine grinding, yet, when grinding merely to minus-200 mesh, and minimizing over-grinding as much as possible, the difference in cyanide consumption is not excessive.

COMMENTS

The principal conclusion to be drawn from this investigation is that when unusually fine grinding is needed for any ore or concentrate in preparation for cyanidation, iron grinding surfaces will cause an abnormal consumption of cyanide. This is not difficult to understand in the light of the formula Na_4FeCN_6, where 1 lb. of iron absorbs over 5 lb. of sodium cyanide in effecting the combination, and considering also the exceedingly fine state of subdivision of the detrital iron and the enormous surface consequently exposed to the action of the solution. This tendency will, of course, be present in any fine-grinding operation, but in the case of the usual moderate degree of comminution for all-agitation plants it may or may not assume commercial importance.

The tests have shown in some instances an increased lime consumption when the iron-lined mill is used, but this, though interesting, is unimportant economically.

In addition to the matter of cyanide consumption, a notable point is the difference in extraction in favor of rubber liners shown in some of the tests. A part of this difference may possibly be the result of difficulties inherent in laboratory testing, the difficulty in this instance being in keeping up the cyanide strength to a definite figure throughout the entire period of agitation. This is easy enough on a working plant which has constant attention 24 hours a day and unlimited solution for titration purposes. In laboratory work, however, on 200-gram charges, it is not so easy. Consequently, in the tests here detailed it was found that in high-cyanide-consumption charges the average cyanide strength during agitation was much lower than in the low-consumption charges. Another factor which might account for part of the difference is the reducing or de-aërating action of the fine iron on the solution. On the other hand, it is to be remarked that not all the samples tested showed a difference in extraction in favor of the rubber liner, a fact which would suggest that in those samples that show an important fall in extraction attributable to the iron liner the cause may be the occurrence of some substance in the ore itself that in the presence of the fine metallic iron forms a combination for some reason deleterious to extraction. An analogy to such a condition would be the incompatibility of zinc with arsenic and antimony in a cyanide solution, such combination usually resulting in seriously lowered extractions. Perhaps some of your readers may help us to decide whether the subject of iron grinding surfaces in cyanidation and the results shown in this article have any general importance in the industry or are of only limited application.

E. M. HAMILTON.
San Francisco, Calif.

Relative Speeds of Ball Mills and Rod Mills

To the Editor of "E.&M.J.":

A few years ago I had the privilege of inspecting the original records pertaining to the operation of the test between a ball mill and a rod mill at a local concentrator. Considerable money was spent in conducting this test and a great deal more was influenced by the reported results.

The first item that caught my attention was the speed at which the ball mill was operated. This mill was 8 ft. diameter and 6 ft. long and was operated at 26 r.p.m. I leafed through the data sheets to see if this speed had been reduced, but, to my surprise, I found that, according to those records, it had not been. In the data it was also noted that the rod mill, 6 ft. diameter by 12 ft. long, was operated at a speed of 17½ r.p.m. For some reason, apparently, the ball mill had been operated at a peripheral speed of about double that of the rod mill.

Without attempting to start a controversy as to the proper speed of rod mills, it would seem apparent that, since each type of mill is governed by approximately the same factors, either the ball mill or the rod mill had been operated at an improper speed. Those who are familiar with ball-milling practice know that speeds above 20 r.p.m. for 8-ft. diameter ball mills are extremely rare. Those who are not familiar with such practice may note in the data published by manufacturers of ball mills that recommended speed for average conditions is 18 r.p.m. for mills 8 ft. in diameter.

A short time after having seen these data I discussed the matter with one who had been active in the operation of the test, and it was his opinion that the ball mill had been operated under very unfavorable conditions and could not have operated at more than 75 per cent efficiency. At that time I expressed the opinion that, if the speed conditions were as indicated in the data I had seen, the ball mill could hardly have been operating at over 50 per cent capacity.

It has been my observation that at practically all rod-mill installations of large size there has been a feeling that possibly the mills were not delivering the results expected of them, and yet there was nothing to prove the contrary. Recently, the fact that many rod mills are being supplanted by or changed into ball mills gives rise to the thought that the rod mill was not able to deliver the results that the original "test" promised. It would be interesting to have this situation cleared up, as I believe that it would throw some light upon the "haze" that now surrounds the question of ball- or rod-mill supremacy in a given field.

D. H. FAIRCHILD.

Salt Lake City, Utah.

Precise Nomenclature May Clarify a Metallurgical Issue

To the Editor of "E.&M.J.":

In a recent editorial I note a distinction is made between the terms "extraction" and "recovery," in referring to hydrometallurgical operations. The terms are very loosely used by mining engineers. The use of the word "extraction" when referring to the removal of ore from a mine is generally accepted; but in concentration processes, and in hydrometallurgy, there seems to be no general understanding as to how the terms should be differentiated. Some metallurgists speak of an extraction by flotation of 90 per cent; others of a recovery to express the same thought.

I have generally followed the practice of speaking of recovery when concentration processes were involved in which the desired metal in elemental form was not extracted, but rather a compound, such as its sulphide. The word "extraction" I have confined to use where the metal is, in its elemental form, extracted from its compounds by amalgamation, cyanidation, or acid leaching. This view is, I admit, somewhat empirical.

Your use of the terms is somewhat different, and it seems to me that some standard terminology should be decided on, if possible, that will be generally applicable.

METALLURGIST.

New York, N. Y.

[Our correspondent draws attention to a subject that was opened for discussion several years ago in *Engineering and Mining Journal* and in the *Proceedings* of the A.I.M.E. The proposals then made, to which no objection was raised, followed a realization that the method of statement of a result in many metallurgical operations offers an example of the ambiguity of phraseology in common use—an ambiguity that often obscures the net economic result and renders the information valueless. As was maintained at that time, the fundamental idea underlying the word "extraction" is "withdrawal." Its definition in a metallurgical sense is "to withdraw by treatment with a solvent or other means." Metallurgical processes may generally be classified into two principal steps. The first is concerned with the preparation of the ore and the extraction of the metal, usually in a concentrated form. The second stage is for the purpose of obtaining a final product from the concentrated mineral, solution, or gas, such final product being usually in metallic form. Thus, the actual amount obtainable is the "recovery." Extraction invariably exceeds recovery, but the amount recovered is the crux of the matter; it is the determining factor as to whether or no the process is suitable or being efficiently performed. No discussion need be closed as to the merits or unsuitability of any particular system of nomenclature; and correspondence is invited criticizing the practice of using the word "recovery" to refer only to the final product of metallurgical treatment, usually as refined metal; and the term "extraction" as indicative of progress before metallurgical operations are completed, and when a concentrated but not a refined product is obtained.—EDITOR.]

By the Way

Miners in Germany Showed Meticulous Care in Diction

IN CONNECTION with the efforts *Engineering and Mining Journal* is making to insure uniform practice in the use of mining and metallurgical terms, a point brought up by Dr. P. Martell in a recent issue of *Der Bohrhammer* shows that German miners meticulously investigated the meaning of a word before they used it.

"'Glückauf' is not so old as might be supposed," writes Dr. Martell. "It does not go back beyond the seventeenth century, and only came into general use in the second half of that century as a form of greeting among the miners. No trace of it appears either in the Sarepta or in Malthesius' writings, nor is it to be found in the oldest collection of mining terms—the old Mining Booklet of 1534. 'Glückauf!' cannot be found in the old mining songs which appeared before the seventeenth century, whereas it is often used in later songs.

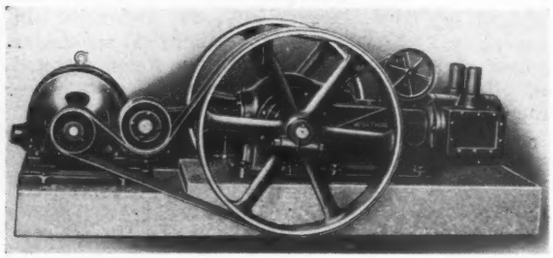
"As regards the derivation of this old form of greeting, Christopher Herttwig gives the following explanation in his work, 'New and Complete Mining Book,' published in 1710: '"Glückauf" is the commonest form of greeting among the miners. They would take it badly if greeted by "Gluck zu," because the underground passages and opening must remain open and not close up.' It would appear, then, that 'Glückauf' is really a contraction of 'May good luck open for you,' in contrast to 'May good luck shut you in (the mine.)'

"Speaking of this miners' greeting in his 'German Mythology,' Jacob Grimm mentions a case of superstition taken from the old wives' philosophy of Chemnitz, where it is written: 'Never say "Glück zu" in the pits, but "Glückauf," or else the workings will fall in!'"

The Equipment Review

SEVERAL new machines and devices having application in the mine, shop, and plant have been recently introduced. They are briefly described in the following:

One of the most recent applications of roller bearings is to be credited to the Worthington Pump & Machinery Corporation, Harrison, N. J. This company has taken its series of single, horizontal, straight-line compressors, ranging in capacity from 100 to 350 cu.ft. per minute, and has equipped the main crank shaft journals with Timken bearings. Inasmuch as compressors of this type and capacity are customarily used by smaller power plants, many of which do not have skilled operators, the elimination of bearing adjustments will remove the principal cause of worry and expense in operation. Oil rings, which deflect the surplus oil and return it to the crank case, are mounted on the shaft beyond the bearings. The crank-case inclosure is designed so as to be strictly oil-tight and free from the leaks usually found in such equipment. These compressors are equipped with feather valves. They can be supplied with ball-bearing idlers for shaft belt drives; with the Texrope drive; or a synchronous motor may be mounted directly on the compressor crank shaft, thus eliminating the transmission mechanism.



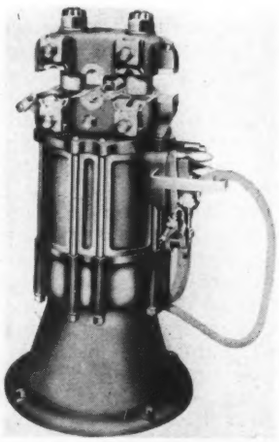
Anti-friction roller bearings now feature this small portable compressor

A Compact Drill Sharpener

Low air consumption and unusual power for its size are outstanding points of a new drill sharpener (Model DS-3A), which has just been put into use by the Gardner-Denver Company, of Denver. The new machine is only 44½ in. high with a base diameter of 24 in., and weighs 1,500 lb. It is equipped with two vertical cylinders, the upper of which is utilized independently in forging operations and the lower of which is brought into play only when clamping. Both cylinders, however, are used in clamping, thus giving added clamping power. This machine will forge bits and shanks and sharpen section drill steel not exceeding 1¼ in. in diameter and not requiring a bit more than 2½ in. diameter. It will also form lug shanks on 1-in., 1⅛-in., and 1¼-in. round steel, and make collared shanks 3¼ and 4¼ in. in dimensions on ⅞- and 1-in. hexagon or quarter-octagon steel.

Another Carbide Lamp

A new model of carbide lamp has been added to its line by the Justrite Manufacturing Company, 2061 Southport Ave., Chicago. This lamp has developed 18 c.p. and will burn for eight hours on an 8 oz. charge of carbide. It weighs 20 oz. It is 6 in. high and 2⅞ in. in diameter at the bottom. It has a 4-in. reflector of extra-heavy nickel plate, giving a larger volume of light than usual. It may be had in brass or tinned steel. Dirty water may be used, inasmuch as the valve stem can be taken out and cleaned, the light not going out meanwhile.



A drill sharpener that is unusually powerful for its small size

Floodlight Has Wide Application

One of the accompanying illustrations shows a small, compact headlight (Type ADA) just announced by the Crouse-Hinds Company, Syracuse, N. Y. Distribution of the light can be varied from a narrow-beam spotlight to a wide and short range floodlight. The beam can be made either round or elliptical. Colors can be obtained with heat-resisting lenses. The reflectors are of crystal glass and smooth, hammered surface. Customarily, the hammered reflector is used with a 200-watt, PS-30 lamp, and a smooth reflector with a 250-watt, G-30 lamp. A 150-watt, PS-25 lamp, as well as the 200-watt lamp mentioned, can be used for short range, and the 250-watt lamp for long range.

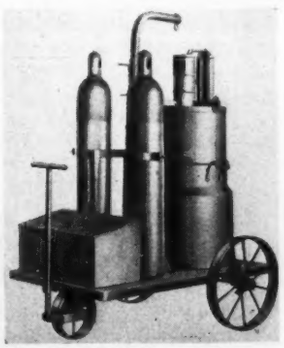
The range of this floodlight can be varied greatly

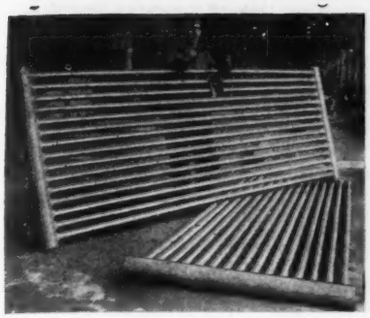
More Welding Apparatus

Despite the wide variety of welding machines and devices already on the market, new equipment for this field continues to make its appearance.

General Electric has just announced a new clamp-type electrode holder with jaws of heavy copper alloy, notched to hold firmly any size of electrode wire from 1/16 to ¼ in. diameter, in any position. The operator is protected from heat and from contact with current-carrying parts by a moulded, compound handle. The holder is designed for use

A new acetylene generator truck



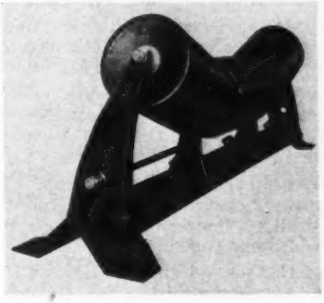


Steam oven coils, such as these, may now be built by electric welding

with currents up to 300 amp. It may be had, if desired, with 5 ft. of extra flexible cable and terminal.

Two Trucks for Gas Generators

Two new types of trucks to accommodate acetylene generators have been introduced by the Oxweld Acetylene Company, 30 East 42d St., New York. These are intended for Type CLP-3 and Type CLP-2 carbic low-pressure generators. The first of these is illustrated in one of the accompanying cuts. The truck designed to carry the CLP-3 generator carries two cylinders of oxygen and is strongly built and oxy-acetylene welded. It may be turned in a radius approximately equal to its own length. The generator is secured to the steel deck of a truck by means of braces and bolts. A smaller truck, not shown,

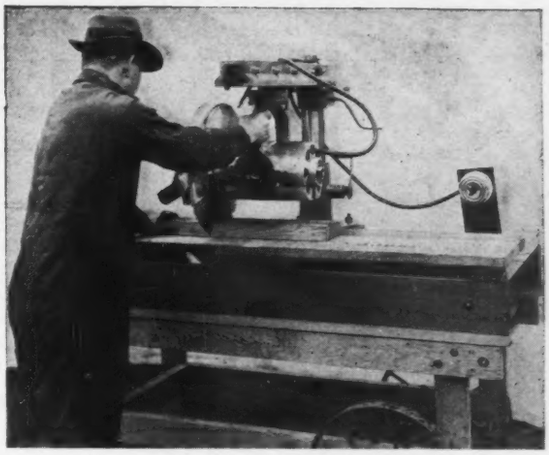


A demountable idler for conveyors

will accommodate one cylinder of oxygen besides the generator.

The Westinghouse company also contributes something in this field, this in the welding of coils to be used in a steam oven for baking railway armature coils. Recently one of the company's welders succeeded in building up coils of this sort by arc welding only. Previously such coils had been fabricated by oxy-acetylene welding or had been cast. Arc welding had not been resorted to, as it was realized that an imperfect arc-welded joint would lead to difficulty and expense in repairing. However, arc welding was used with success. The coils are intended for operation at 150-lb. steam pressure. When completed, they were tested under 500-lb. water pressure and found absolutely tight. They are shown in one of the cuts.

Not fewer than 29 operations can be performed with the new portable woodworking machine shown on the right



A Demountable Conveyor Idler

The type of idler most recently introduced by the Robins Conveying Belt Co., New York, is similar to the well-known 203 XR three-pulley Timken-bearing idler, with the exception that it has demountable pulleys. The three pulleys with their bearings and grease seals are identical and interchangeable. Each is of cast iron, with totally inclosed ends, and without dirt pockets. Each pulley with its dead shaft of heavy, seamless cold-drawn tubing can be lifted out without the use of tools except to disconnect one section of the grease line leading to the center pulley. The side pulleys are set at an angle of 20 deg. from the horizontal, thus giving high capacity without bending the belt enough to impair its life. The gap between the pulleys is about ¼ in., making it impossible for the belt to be caught or creased at this point.

An Improved Wood Worker

Without sacrificing the portability or versatility of the DeWalt woodworker, the manufacturers have developed improvements in their Model D machine that makes possible the delivery of fully 50 per cent more power, whether the ripping, crosscutting, dadoing, mitering, beveling, or any of the 29 other operations that are done on this one machine by various tool attachments.

This so-styled Model D "Wonder-Worker" is powered by a two- or three-phase, 5-hp. motor of new design, with greater power on full load, and less temperature rise.

The new machine is fast enough to rip 4-in. fir at the rate of 50 ft. per minute. It crosscuts 6 in. material and can be switched instantly from cross-cutting to ripping without turning off the power. The cutting tool is completely guarded in all positions.

Another improvement in this model is the placement of the dial plate with degree markings and pitch scale in front of the operator for easy adjustment for angle or bevel cutting. The dial plate is notched at each 45 deg. for the quick finding of such angles. The motor is locked instantly and securely in any cutting position by means of a positive locking device and convenient hand lever, so that all changes in adjustment are made instantly and surely. A change of tool attachments on the arbor of the motor required only a few seconds.

This Model D machine, manufactured by the DeWalt Products Corporation, of Leola, Pa., is readily portable, weighing only 340 lb. and is fitted on a table, 29x59 in., that can easily be handled by two men.

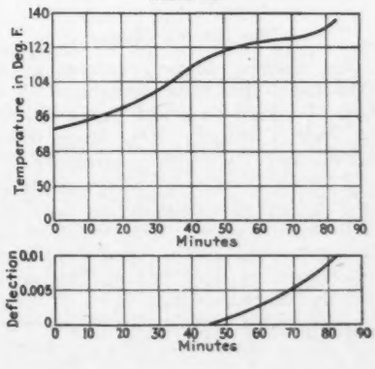
Another New Starting Switch

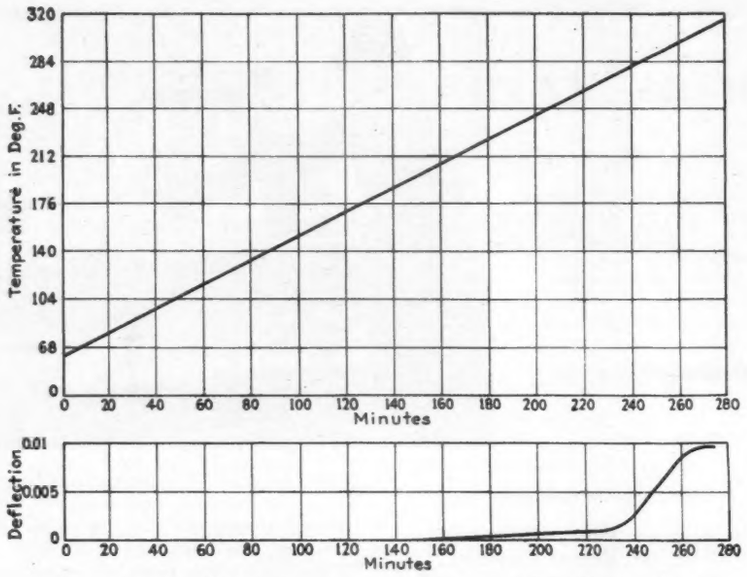
A new manual starting switch, developed by General Electric, is designed to meet the demands for a small device which will throw motors across the line. It is designated as CR-1038 E-1, and has a maximum rating of 1 hp., 110-volt, and 2 hp., 220 to 600 volts, 3 phase. It consists of a tumbler switch and two small thermal cutouts mounted on a common texolite base. By means of suitable interlocks, the switch can be locked in either open or closed position.

An Acid-Proof Trolley Hanger

In mining service the molded insulation in hangers is subjected to severe operating conditions. In many mines water collects on the top and runs down over them. In most mines during the warm months considerable moisture is caused by condensation. In all of this water sulphuric acid is present and attacks the glaze on the surface of the molded insulation. In time this glaze becomes sufficiently broken to allow moisture and dust to form a path across the surface. Leakage over the surface

Results of a distortion test made on ordinary molded insulation material





Results of distortion test made on newly developed molded insulation material described in text

then begins and soon a carbonized path is established. In time this leakage will cause the hanger to heat up so that the molded material will become ignited. Mine fires are often started in this way.

Westinghouse mine hangers are now furnished with an insulation known as Moldarta. This has a surface glaze which is not affected by acid water. In service tests in one mine, which has very bad water conditions, fifteen of these hangers were installed. They were alternated with fifteen hangers using the shellac mixture molded material. All of the hangers using the latter have since been replaced twice, whereas those composed of Moldarta are still in service. The new material is about 50 per cent stronger than the shellac or the shellac substitute mixture. Moreover it will not soften under heat and will resist shocks much better than ordinary molded material.

Three New Packings

Some new packings for various kinds of service have been introduced by Greene, Tweed & Company, 109 Duane St., New York. These are the "Cutno," intended for use where caustic soda and similar chemicals and ammonia are used; the "Pelro," for use with gasoline, naphtha, alcohol, and the like; and "Palco" for hydraulic pressures.

An Electric Shaper

An electric shaper, known as the "Workace," has been introduced by the J. D. Wallace Co., 134 South California Ave., Chicago. It is direct motor-driven, and is portable. Armature shaft and shaper spindle are integral, the belt having been eliminated to avoid slipping and slowing down the operation and losing power. At no load the shaper has a speed of 10,000 r.p.m. The spindle has a strong steel shaft $\frac{5}{8}$ in. in diameter, extending $3\frac{5}{8}$ in. above table top, and has a capacity of $2\frac{1}{2}$ in. between two steel shaper collars or $3\frac{1}{4}$ in. using solid cutters. The machine operates from a G-E universal motor and can be used on the ordinary lighting circuit, 110 or 220 volt, d.c. or a.c., 25 to 60 cycles. It weighs 42 lb.

INDUSTRIAL NOTES

Wells, Fargo & Company, S.A., Mexico, D.F., has been appointed sales representative in Mexico for the Manganese Steel Forge Company, of Philadelphia.

The Virginia Cellulose Company, of Hopewell, Va., has merged with The Hercules Powder Company. Although Hercules has assumed full control, the plant will operate as heretofore.

The Copperweld Steel Company has formed the southeastern district comprised of Georgia, Alabama, Tennessee, Florida, Mississippi, and part of Louisiana, with P. A. Terrell in charge as district manager. The office of this district is in the American Traders Bank Building, Birmingham, Ala.

The American Hoist & Derrick Company, of St. Paul, announces the opening of a branch office and warehouse in Los Angeles, Calif. The office and warehouse is located at 337 South Anderson St. W. H. Lummus, who has represented the American Hoist & Derrick Company on the West Coast for many years, is in charge at Los Angeles.

The International Nickel Company, New York City, has issued two new bulletins on nickel and nickel-chromium cast iron. Bulletin No. 201-a discusses the position of cast iron in the engineering field, the trend toward improvements in physical and mechanical properties, and the rôle of alloys in this connection. Bulletin No. 207 supersedes Bulletin No. 201, the present publication being expanded to include more than 25 important applications of nickel cast iron.

BULLETINS

AIR-JACKETED MOTORS—Wagner Electric Corporation, St. Louis, Mo. Bulletin 151, third revision, contains a discussion of dust, fume, and moisture problems.

LUBRICATION—E. F. Houghton & Company, Third, American and Somerset Sts., Philadelphia, Pa. Booklet on Industrial Plant Lubrication. Fifty-six pages.

GAS ENGINES—Chicago Pneumatic Tool Company, 6 East 44th St., N. Y. City. Bulletin No. 782, vertical gas engines. Sixteen pages.

BLOWERS—The P. H. & F. M. Roots Company, Connersville, Ind. Bulletin No. 22-B1, low-pressure type rotary positive blowers. Sixteen pages.

PUMP LININGS—The U. S. Stoneware Company, 50 Church St., N. Y. City. Bulletin "D," centrifugal acid pumps. Eight pages.

PYROMETER—Roller-Smith Company, 233 Broadway, N. Y. City. Bulletin No. 400, Type FD (4-in.) pyrometers. Four pages.

MOTORS—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Leaflet No. 1101-D, direct current mill motors.

TURBINES — Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Leaflet No. 20401, describing Type AD mechanical drive turbines.

SWITCH—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Leaflet No. 20408, Class 13-100 non-reversing magnetic starter.

MACHINE TOOLS—U. S. Electric Tool Company, Cincinnati, Ohio. Catalog Nos. 25 and 26, which is devoted to more than fifty portable electric drills and heavy-duty grinders.

MOTORS — General Electric Company, Schenectady, N. Y. Bulletin No. GEA-788A, Type FT. Four pages.

SWITCHES—General Electric Company, Schenectady, N. Y. Bulletin No. GEA-181A, CR7006-D7 and D9 A-c, inclosed magnetic switches. Two pages.

HEAT TREATMENT — General Electric Company, Schenectady, N. Y. Bulletin No. GEA-801A, tempering baths electrically heated. Four pages.

COMPRESSORS—General Electric Company, Schenectady, N. Y. Bulletin No. GEA-588B, centrifugal compressors geared units. Four pages.

CORE DRILLS—Ingersoll-Rand Company, 11 Broadway, New York City. Form No. 9401, first edition. Description, application and scope of Calyx core drills. An illustrated catalog, containing operating details.

MAGNETIC SEPARATORS—Magnetic Manufacturing Company, Milwaukee, Wis. Bulletin No. 90, especially devoted to magnetic separation for coal, lime, gypsum, and other materials of a similar nature.

ELECTRIC HEAT—General Electric Company, Schenectady, N. Y. Leaflet No. GEC 81A, industrial heating devices. Twelve pages.

LOCOMOTIVE CRANES—Link-Belt Company, 910 S. Michigan Ave., Chicago, Ill. Bulletin No. 1095, illustrated book describing gasoline, Diesel, electric and steam-operated cranes, shovels, and draglines. Forty-eight pages.

LATHES—South Bend Lathe Works, 425 East Madison St., South Bend, Ind. Catalog No. 90-A. Ninety-four pages.

Personal Notes

F. W. Foote has been examining the property of the Vermont Copper Company, in Vermont.

John D. Fields is now at the head of the Merry Widow group of mines in the Inyo County, Calif., field.

W. R. Wade has returned to New York City from a professional visit to the Western mining states.

C. Minot Weld has returned to New York after three weeks' absence on the Pacific Coast on professional work.

Dr. **J. A. L. Henderson** has left England for Canada and the United States, where he will remain for several months.

John Knox, assistant general manager of Hollinger Consolidated, is in the Michigan copper district, accompanied by his family.

L. F. Strobel has returned to New York City from a month spent in Denver and the Cripple Creek district of Colorado.

George Kirvin will have charge of operations at the Empire and Star mines, Grass Valley, Calif., for the Newmont Mining Company.

Austin G. Marsh, mining engineer, formerly with Colorado Fuel & Iron, at Pueblo, Colo., has become affiliated with San Francisco del Oro, in Chihuahua, Mexico.

George W. Roddewig, formerly superintendent of mines for Elm Orlu Mining, of Butte, Mont., is making an examination in the Coeur d'Alene district of Idaho.

Alderson & MacKay, consulting engineers for Towagmac Exploration, have completed an examination of the Lake Geneva mine, in the Sudbury district of northern Ontario.

Charles F. Jackson, of the U. S. Bureau of Mines, stopped in New York City this week, en route to Canada. He intends visiting the principal camps in Ontario and Quebec.

Charles H. Behre, assistant professor of geology at the University of Cincinnati, is continuing, during the summer, a detailed study of the ore deposits near Leadville, Colo., for the U. S. Geological Survey.

Louis J. Joubert, associated with **Frank W. Griffin** in the development of the Edie Creek gold dredge field, in New Guinea, has returned to San Francisco after a year's absence, and plans to stay until fall.

Prof. **C. A. Dart,** of the metallurgical department of the University of Wyoming, has been making some tests of gold ore uncovered in the Utopia Mining & Milling Company's property near Centennial, Wyo.

J. R. Gordon has been appointed by the Ontario government to carry on the work of the Ontario Research Foundation. He will try to evolve a practical process for the reduction or beneficiation of low-grade Ontario iron ores.

George H. Garrey, of Philadelphia, was retained by the plaintiff, and **John Wellington Finch,** of Denver, by the defendant, as geological witnesses in the recent Colorado lawsuit of Commodore Mining vs. Bachelor Mining & Milling.

W. O. Hotchkiss, president of the Michigan College of Mining and Technology, at Houghton, Mich., has been appointed chairman of the committee on mining and metallurgy for the Society for the Promotion of Engineering Education. The society is composed of

W. O. HOTCHKISS

members of faculties of engineering colleges and universities. On the committee are: **R. M. Black,** University of Pittsburgh; **R. S. McCaffery,** University of Wisconsin; **W. G. McBride,** McGill University; **C. M. Young,** University of Kansas; **Joseph Daniels,** University of Washington; and **H. E. Nold,** Ohio State University.

O. S. Arthur, of Denver, Colo., will serve as consulting engineer, and **P. W. Stovell** will be in charge of operations, at the Matilda group of mining claims, in the St. Elmo district of Colorado. The properties were discovered by Mr. Stovell, and are being financed, with option to purchase, by Denver interests.

C. A. Remington has resigned as flotation metallurgist for the Consolidated Mining & Smelting Company of Canada to accept a similar position with the South African Copper Company at Ookiep, Namaqualand, Union of South Africa. Mr. and Mrs. Remington and daughter sailed from New York on the "Berengaria" on Aug. 7.

W. Earl Greenough, of Wallace, Idaho, who has spent the month of July in Washington, D. C., appearing before the Bureau of Internal Revenue, on tax matters, in behalf of the Hecla and the Gold Hunter mining companies of the Coeur d'Alene district, is in Colorado doing examination work. He expects to return to Wallace on or about Aug. 15.

A. F. Main, who recently resigned the management of Compania Inversiones del Oro, of the El Oro Mining & Railway Company of the Buena Tierra Mining Company, the Santa Rosa Mining Company and of the Compania Minera Piedra Bola, all in Mexico, is taking a long vacation in Europe. **G. M. Wasteneys** succeeds Mr. Main in these positions.

John D. Ryan, of New York, chairman of the board of directors of the Anaconda Copper Mining Company, who has been in the Michigan copper district, has left for Butte, Mont., for a visit. He was accompanied in his special car by **James MacNaughton,** president of the Calumet & Hecla Consolidated Copper Company, and **R. L. Agassiz,** of Boston, chairman of the board of directors of Calumet & Hecla, who will be his guests on the pleasure trip.

OBITUARY

George E. Reynolds, formerly engaged in the mining industry in Central City, Colo., and more recently in Miami, Ariz., died in Miami on July 22. Mr. Reynolds was 60 years of age.

L. O. Bastain, of Silverton, Colo., died recently, after a short illness. Mr. Bastain was born in Norway in 1876, and went to the San Juan district in 1898. He had been construction superintendent for many of the mines of the district.

James H. Hawley, former Governor of Idaho, died in Boise on Aug. 3, after a long illness. He was originally attracted to Idaho by the discovery of gold, and participated in the first rush for holdings in the Boise basin in the early '60s. Mr. Hawley was 83 years old.

James P. Quinn, who was superintendent at the Lakes of Killarney mine, in the Ophir-Dry Canyon district of Utah, died recently at his home in Tooele, Utah. Mr. Quinn was born in Streator, Ill., in 1872. He went to the West when a young man, and spent his life promoting and developing mining properties.

W. S. Eckert, connected with one or another phase of the mining industry throughout his life, died on Aug. 1, following an operation, in a New York City hospital. At the time of his death he was treasurer of W. Parsons Todd, Inc., New York, and connected with the Copper Range Company, to which he came in 1924. He had been with National Conduit & Cable for many years, and later with the Baltimore Tube Company, of Baltimore, Md. Mr. Eckert was active in the formation and work of the Copper and Brass Research Institute. He was 60 years old.

Solon Spiro, former Park City, Utah, mining man, died recently, after an illness of two weeks. Mr. Spiro was born at Kurnik, Germany, in 1863. In 1881 he settled in Park City and engaged in business. In 1900 he organized the Silver King Consolidated Mining Company. Under his management, the property paid over $1,500,000 in dividends. He also started the Spiro drain and transportation tunnel to develop the mine at great depth. Later the mine was acquired by the Silver King Coalition Mines Company. Since 1924, when he retired, Mr. Spiro had lived in New York and Florida.

Book Reviews

MINING SUBSIDENCE. *By Henry Briggs. London: Edward Arnold & Company. Pp. 215. Price 14s.*

THIS critical exposition of current thought on a much neglected phase of mining is a welcome contribution to technical literature, calling attention as it does to a field of inquiry which when more perfectly understood has vast possibilities. In the ultimate analysis all underground mining methods are based on the elements of support, which, whether permanent or temporary, control or invite collapse of rock masses. If then by reasoned study it may be known how rocks react to varying conditions of stress and strain, modifications of methods and improvements in practices may result.

Hitherto maintenance of ground has been discussed solely from the viewpoint of protection of life and property, but the science of petrodynamics has great practical promise in its economic and technologic application. However, as if to curb enthusiasm, a word of caution appears in the first few pages of the book, for we read, "Chance—if by that we mean the uncalculable residuum of consequences—will always remain an active ingredient of the problem, and nothing short of omniscience would enable us to foretell exactly what to expect at the surface when a seam of coal is mined below it."

Professor Briggs introduces his subject by citing numerous examples of the disastrous manifestations of ground settling. His comment on the rôle of hydrostatic and particularly petroleum support will receive attention from those exploiting soluble or liquid mineral substances. He proceeds with a synopsis of the laws of support and the obligations of mine operators, giving proper emphasis to the findings of the Royal Commission on Mining Subsidence. Chapter III is devoted to a fair-minded analysis of the theories of subsidence past and present. We gain confidence in the masterly handling of the subject by such statements as "nothing is easier than destructive criticism when dealing with mine subsidence, whose only uniform characteristic is an endless variability." Discussion of Fayol's and Eckardt's theories points the danger of attempting to determine blast-furnace practices by test-tube experiments. Chapter IV treats of precautionary measures. Though perhaps the fundamentals are the same, there are probably many engineers who will regret the restriction of discussion to the working of coal measures. Generous recognition of the work of American engineers is made, although for a book dated as late as April, 1929, we might expect mention of the painstaking researches of W. R. Crane in the iron mines of Alabama and copper and iron deposits of Michigan.

The reviewer finds the real contribution of the book in chapters VII and VIII, wherein fracturing and failure of rock masses as a result of bending moment and shear are discussed with the same lucid analysis, free from prejudice or dogma, characteristic of the book throughout. Professor Briggs would perhaps have added to the value of his work had he expanded his treatment of "shear" to the very important and practical problems confronting every large-scale open-pit operation.

"Mining Subsidence," by Henry Briggs, commands attention. It will be widely read. Mature thought finds expression in scholarly language and is illustrated by readable sketches and diagrams. The book is well annotated. It is, as the publishers announce, "A brilliant critical survey of the theories and results of mining subsidence"; it bristles with suggestions for further study, but in the present state of our knowledge of the subject we are inevitably forced to agree with Kipling:

"O what avails the classic bent, or what
the cultured word,
'Gainst the undoctored incident, that
actually occurred."

FRANK H. PROBERT.

X-RAYS IN INDUSTRY. *Rochester, N. Y.: Eastman Kodak Company. Pp. 60, illustrated.*

THIS booklet has been prepared to suggest some of the industrial applications of X-rays in inspecting the internal construction of opaque materials.

It is not the function of the booklet to go deeply into a scientific discussion of the subject, but rather to state briefly how X-rays are produced, to describe the necessary apparatus, and to present some rules for the proper exposure and manipulation of radiographic films.

No mention has been made of the diffraction method of analysis and its manifold applications. It is the intention of the Eastman Kodak Company soon to publish another booklet which deals with that phase of the subject.

There will no doubt occur to the reader many applications of radiography peculiar to his own industry that are not mentioned here. The company will be glad to discuss with such manufacturers the feasibility and cost of X-ray examination.

A bibliography of the books published on this general subject is appended and some of the recent technical articles, to which the reader is referred for a fuller scientific treatment.

CUTTING MATERIAL HANDLING COSTS. *By C. M. Ballard and D. C. Sherman. Williamsport, Pa.: Williamsport Wire Rope Company. Pp. 146.*

THIS TREATISE covers the theory and practice of the transport of ore and other material by rope tramway. Costs are discussed, and a comparison is made with other methods of conveyance. The various types of cableways and tramways, towers and structures are described in detail. Data are given in regard to driving and retarding power. The problem of location, with particular reference to contour of the country, is dealt with in a helpful manner. Instructions of considerable practical value on the erection and operation of rope tramways are also presented. The book concludes with an adequate mathematical dissertation with respect to spans, guard screens, the forces in traction ropes, sheaves and saddles, anchorages, the capacity of such installations, and other data. It is well illustrated and indexed, and should prove of considerable value to mining engineers confronted with a materials-handling problem that could be solved by the adoption of the rope tramway. The volume, which is well printed and bound, will be sent free to any responsible executive making application to the Williamsport Wire Rope Company, 122 South Michigan Ave., Chicago, Ill., or Williamsport, Pa.

GMELINS HANDBUCH DER ANORGANISCHEN CHEMIE. *System-Nummer 59; Eisen; Teil A; Lieferung 1. Berlin: Verlag Chemie, G. m. b. H. Price M. 33.*

IN THE interest of those who are not in touch with the development of chemistry it may be mentioned that this monumental work, sponsored by the German Chemical Society, attempts to present the present status of inorganic chemistry in 22 volumes.

Of the subjects treated so far in the new edition the volume on zinc and cadmium will appeal to the metallurgist. Just now the first part of the treatise on iron has been published and deals with the history and occurrence of iron and its alloys.

The historical chapter essentially consists of the long list of publications on the subject of iron; the list of the iron minerals and their occurrence in the chapter dealing with that subject is so extensive that it gives the impression of completeness. In the chapter on the metal and its alloys it is a pleasure to note how well the subject is brought up to date. To quote an example: the work on electrolytic iron carried out by Eustis and Perin and their co-workers in recent years is discussed at some detail, even stating the numbers of their United States patents.

The new edition of Gmelins' handbook will be one of the most valuable assets of every chemical library, and every metallurgical library should at least contain the volumes on the metals of economic importance.

RUDOLF GAHL.

NEWS OF THE WEEK

Summary

JACK Nutt Mines, owning over 200 claims on tin, copper, and zinc properties in the Herb Lake district of northern Manitoba, is making good progress in exploration and plant installation. Page 228.

* * *

Commerce Mining & Royalty has purchased the Anna Beaver mine from Harry Payne Whitney and Consolidated Lead & Zinc has been formed by Frank Childress to operate the newly acquired properties of Lawyers Mining, in the Tri-State district. Page 226.

* * *

Tintic Giant, Tintic Eagle, Tintic Peerless, and Standard Lily Extension Mines have consolidated their properties in the Tintic district of Utah, and will operate from Tintic Giant Shaft No. 2. Page 225.

* * *

Two Arizona properties—Bisbee Expansion, in the Bisbee district, and the Lion mine, in Yavapai County—are being prospected geophysically this summer. Page 224.

* * *

Waite-Ackerman-Montgomery and Amulet mines, in the Rouyn district of Quebec, have each discovered orebodies that may be of great importance. Page 229.

* * *

Tonopah Extension is preparing to develop the 6-ft. orebody discovered on the 1,880 level at the west of its properties, in the Tonopah district of Nevada. Page 224.

* * *

Ore reserves at the N'Kana property of Bwana M'Kubwa Copper, in Northern Rhodesia, are placed by latest estimate at 42,000,000 tons. Page 229.

* * *

The railroad may reach Sherritt-Gordon Mines, in northern Manitoba, by mid-August, five months ahead of schedule, thus enabling construction to be well under way by winter. Page 228.

High-Grade Orebody Being Opened Up On 2,000 Level of Lake Shore Mine

Intersection on Crosscut Made Only 15 Ft. From Shaft—
1,800 Level Development Continues in Rich Ore—
Mill Capacity to Be Increased Soon

THE deepest ore developments to date in the Lake Shore mine, in the Kirkland Lake district of northern Ontario, occurred last week, when a 15-ft. width of ore, described as high grade, was encountered in a crosscut about 15 ft. south of the shaft at the 2,000 level. This ore is the downward extension of the recent discoveries on the 1,800 level. That the intersection was made so close to the shaft—almost in the station in fact—is further evidence against the theory that Lake Shore orebodies have a general dip toward the south.

Meanwhile, drifting east and west at the 1,800 level has opened up the main ore zone at that horizon for a length of 1,000 ft., the grade averaging between $35 and $40 per ton across a drift width of 8 ft. The average actual width of the vein is not yet known.

Of the crushing equipment ordered for the proposed increase in tonnage this fall, one ball mill has been delivered to the property. Forms are now being prepared for pouring the foundations for a new tube mill. Tonnage, which is now between 1,225 and 1,250 per day, will be stepped up in September, it is expected, to about 1,500, with a further increase to above the 2,000 mark before the end of the year. Officials inform the *E.&M.J.* correspondent that if machinery deliveries are made on schedule a production of $1,000,000 a month is likely to be realized before the end of the present year.

A contract has been let for a new 150-ft. steel headframe over the new central shaft, and a new hoist has recently been ordered, as well as another 2,500-cu.ft. compressor. The company is making preparations for filling. A number of sand and gravel claims which lie about 10 miles from the mine have been purchased, and construction has been started on a railway spur across the lake which will permit the gravel being brought by train and dumped direct into the underground workings.

Falconbridge Nickel Builds 25 Homes for Workmen

FALCONBRIDGE Nickel Mines, Ltd., has awarded a contract to Thomas Farley, contractor, for building 25 homes for workmen and officials in close proximity to its mine and smelter in the Sudbury district of northern Ontario. Work on the latter is advancing rapidly. The chimney was completed last week to a height of 175 ft., with the exception of the lining. Concrete foundations are all in and steel work on the furnace building has started. Hamilton Bridge Company has the contract.

Drifting is in progress at the 1,000 level, a double-width drift being driven east and west in the footwall of the orebody. The intention is to crosscut the orebody at this level every 200 ft. Drifting along the footwall of the orebody has also started at the 250 level. The intention is to drift along the footwall for a distance of about 500 ft. west of the shaft, where it is intended to raise to the old Longyear shaft. This shaft was sunk a number of years ago to a depth of about 165 ft. The 1,800-cu.ft. Belliss & Morcom compressor is installed and will be operating in a few days.

International Commission Studies Trail Damage Claims

REALIZING that at least two years must elapse before any plan for the final settlement of damage claims against the Trail smelter can be worked out, specialists in the service of the International Joint Commission and those representing several government bureaus are trying to arrange for part payment on claims for crop damage by sulphur fumes from the smelter.

Consolidated Mining & Smelting, the owner of the smelter, does not deny that farms on the American side of the border have suffered damages, but there is a wide difference of opinion as to the extent. The company long has been willing to take over certain lands where the danger of damage is greatest, but has been precluded by the laws in the State of Washington, which provide that lands may not be acquired by the nationals of other countries.

Geophysical Prospecting Used at Bisbee Expansion

THE claims of the Bisbee Expansion Company in the Naco Hills, near Bisbee, Ariz., are to be surveyed by three geophysical methods by Prof. J. A. Malkovsky, head of the department of geophysics of the Colorado School of Mines, and two assistants. The three methods which will be used at Bisbee are the magnetic, gravitational, and electrical. About two months will be required to complete the survey. The Bisbee Expansion group of claims is two miles long and one mile wide and is the largest piece of property in one body in the district.

Another Arizona property which is to be prospected geophysically is the Lion mine, near Mayer, Yavapai County. This mine is also being developed by drifting. The shaft has been equipped with a new 25-hp. hoist and is to be retimbered to the 300 level. In the 170-ft. crosscut east of the shaft on this level there is said to be 60 ft. of ore. The bottom of the shaft is reported to be in rich ore, and diamond drilling has shown that the ore persists to an additional depth of 60 ft.

United Republic Gold Construction Progresses

WORK is proceeding rapidly on the construction of the 150-ton flotation mill at the Century mine of United Republic Gold Mines at Chloride, Mohave County, Ariz. A 300-hp. oil engine, a 300-hp. generator, a crusher, ball mill, and a six-cell flotation machine have been installed. The shaft has been equipped with a new pump and a new hoist. The air compressor is also new, and some machine drills have also been purchased. New camp buildings and residences are being built. The vein has been opened for 1,100 ft. north of the shaft and for 440 ft. to the south, with 250 ft. of backs. On the 100 level a parallel vein has been opened up for 234 ft. The ore contains copper, lead, zinc, and a little gold.

Arizona Magma, in the same district, has equipped its Bella Union shaft with a 25-hp. gas hoist and a new headframe. The shaft is to be unwatered. The company also operates the Diana mine, at Chloride, and plans to erect a new mill at that property.

Pacific Copper Will Be Sold

The Pacific Copper Company will be disposed of at a receiver's sale, to be held at Houghton, Mich., on Aug. 16. Prof. C. H. Baxter is receiver. It is understood that the purchaser will be the St. Mary's Mineral Land Company, which is now the largest stockholder in Pacific. The property adjoins the Atlantic tract of Copper Range, and contains the northerly extension of the Ashbed lode.

California Rand Silver Sells Kelly Mine and Mill

CALIFORNIA Rand Silver has sold the Kelly mine and mill, near Randsburg, San Bernardino County, Calif., to the J. E. Knapp Company, dealers in mine machinery, of San Francisco. The workings will probably be dismantled. Thus ends the record of one of the richest silver mines of the state. Between 1919 and 1925 it produced 353,699 tons of ore, yielding 39,697 oz. of gold and 13,017,476 oz. of silver, of a net value of $9,531,472. Dividends during that period were almost 300 per cent on an initial capitalization of $1,280,000. In 1921 California Rand was the leading silver producer of the country.

Mount Nickel Drilling of U. V. X. Reaches 1,600 Ft.

THE deep diamond drill hole which United Verde Extension Mining, of Arizona, is putting down to explore the norite-sedimentary contact on the old Mount Nickel property in Blezard Township, in the Sudbury district of northern Ontario, has reached a depth of 1,600 ft. and is being continued. Up to the present there have been no signs of the contact zone appearing in the core.

Drilling on the Mount Nickel property last fall gave only meagre indications of extensions of known ore occurrences on this property, but it was decided this summer to resume the drilling in an effort to obtain more information from greater depths. In its exploratory efforts in the Sudbury district, United Verde Extension has made it plain that it is not looking for an entry into the nickel business, but has in mind the possibility of encountering copper enrichment somewhere along the contact zone at depth.

Gold Zone Divide Leases Divide Property

GOLD ZONE Divide Mining has suspended operations on company account at Divide and will confine its activities to its group of claims at Gold Hill north of Round Mountain, in the Tonopah district of Nevada. The Divide property has been leased to Martin Everson, George Harma, and Alex. Anderson, former mine employees. They will start leasing operations on the intermediate level below the 500, and on the 600 level. From the 500 and the intermediate level, 38 carloads of ore were shipped by Gold Zone. The work on the 600 level was unsatisfactory.

The character of the work at the Gold Zone's Gold Hill property will depend largely on results of work on the 400 level, where the crosscut is now approaching the vein.

Tonopah Extension Prepares to Develop New Orebody

THE new oreshoot on the 1,880 level opened in the west in Tonopah Extension is now reported as 6 ft. wide and of good milling grade, with occasional bunches of high grade. Extension increased operations on Aug. 1 from an eight- to a ten-hour day. The mill is now treating 165 tons daily. The principal source of ore is from vein 1,531 on the 1,540 level. This is the same vein in which ore has been exposed on the 1,880 level, indicating the importance of the new strike. On the 1,540 level the ore has been raised on 200 ft. and a winze is down 60 ft. below the level. On this level the orebody is from 15 to 20 ft. wide, and the raises have not yet reached the top of the body.

Tonopah Belmont Suspends Operations

CLYDE A. HELLER, president of Tonopah Belmont Development, announces that work on company account has been suspended. The mine, near Tonopah, Nev., will be leased, giving old employees of good record the preference. The company will provide power, compressor, and drill sharpeners. Mr. Heller states that lessees may make money on royalty, whereas the company would not break even, owing to heavier overhead. The Belmont has made an enviable record as a dividend payer since 1906, but of late with depletion of the larger orebodies there has been little profit.

Oregon Waterpower Development Planned

FRED J. BLAKELEY and associates, of Portland, Ore., owners of the Sterling placer mine, near Medford, Ore., have filed claims on the impounded waters of the Two Squaw Lakes, the headwaters of the Applegate River, for mining and irrigation purposes. They have incorporated under Oregon law the Medford Waterpower & Development Company, with a capitalization of $1,000,000, to finance the project. The impounded waters will afford 25,000 acre-feet of water annually for irrigation, for the Sterling placers and other mines during the non-irrigation season, and a steady flow throughout the year for power and other purposes.

Genii Tunnel Fails to Hit Mammoth Channel

The 3,100-ft. tunnel driven by Genii Mining, near Magalia, Butte County, Calif., has been found to be 60 to 150 ft. above the bed of the Mammoth channel, which it was at first thought to have penetrated. Further efforts will undoubtedly be made to reach the buried Tertiary river bed, which geologists think contains gold deposits.

In the Tintic district, Utah, looking east from Godiva Mountain

Four Tintic District Companies Merge for More Intensive Development

By Gail Martin
Special Salt Lake City Correspondent

FOUR companies — Tintic Giant, Tintic Eagle, Tintic Peerless, and Standard Lily Extension Mines, owning the Evangeline group—are co-operating to develop ground amounting to more than 1,500 acres in the Tintic district, 6 miles east of the Tintic Standard mine, at Dividend, Utah.

The Tintic Giant No. 2 shaft has been selected as a central point of operation, from which drifts will be extended into the various properties to cut the ore-bearing horizons of the Ophir limestone formations, productive in the Tintic Standard, the North Lily, and the Eureka Lily, Desert, and Eureka Bullion properties of Chief Consolidated Mining.

First work in this area, characterized by pronounced surface mineralization, was done by Riter and Burleson in 1884. Manganese ore was mined from a surface outcrop of over an acre in extent. John Bestelmeyer also prospected in this locality some years later. During the war manganese was mined from the surface of the Tintic Eagle and shipped.

Until the North Lily strike, when interest in the Ophir formation was revived, the area has lain dormant. Last year, development was undertaken under the direction of H. Greeley Snyder, manager of the four associated companies.

Several miles of water lines were laid and a substantial camp, with offices, hotel, and cottages, was built. Sinking of the Tintic Eagle shaft and the Tintic Giant No. 1 shaft was begun and some drifting done. Later development has been centered on the more central location at the Tintic Giant No. 2 shaft, which has been sunk to the 650 level. This shaft, a double compartment and manway, is equipped with air hoist, compressor, blacksmith shop, and change room. On the 608 level, the company is drifting northwest on the contact of the Ophir limestone and Cambrian quartzite. Within 200 ft., the Tintic Eagle property will be entered. To the southeast on the same contact, a drift is being advanced to the Evangeline group of Standard Lily Extension Mines. Standard Lily Extension, Tintic Peerless, and Tintic Eagle all own an interest in Tintic Eagle shaft No. 2.

Other members of the staff of the associated companies besides Mr. Snyder are: J. C. Jensen, managing director; E. S. Bowman, assistant manager and geologist; W. A. Young, geologist and engineer; and Frank Jardine, superintendent.

Virginia Manganese Producer Prepares for Operation

Midvale Manganese, at Midvale, Rockbridge County, Va., is being put in condition to start operations. Recent exploratory work uncovered a 20-ft. body of 60 per cent manganese ore. The property is equipped with a 100-ton washer and mill. Marshall Haney is in charge of operations.

New Bingham Mary Starts Operations

Operations have been started in the property of New Bingham Mary Mining, at Bingham, Utah, in ground surrounded by Utah Apex and Utah Delaware. George Wilson is manager. The company is drifting from the Climax drift of the Parvenue tunnel, to explore known fissures in the Yampa limestone.

Consolidated M. & S. Starts Sampling at McCarthy-Webb

SAMPLING is in progress on the McCarthy-Webb property, in the Goudreau district of northern Ontario, recently acquired under option by Consolidated Mining & Smelting. It is understood that the initial payment, which fell due on July 28, has been made, and that it is the intention of the company to proceed with an active campaign of development immediately.

The McCarthy-Webb claims have been examined on frequent occasions by representatives of prominent mining interests, but up to the present comparatively little expenditure has been made on actual development. There is a wide mineralized zone with a series of parallel shear zones, running across the property, and traced by stripping and cross trenching for a distance of about 600 ft. Sampling has indicated somewhat erratic values, but there is said to be a possibility that the shear zones may lead to a considerable tonnage of low-grade material, which might be developed as ore. On a previous occasion Consolidated M. & S. was involved in negotiations for an option on the property, but the deal fell through.

Chief Consolidated Opens Body at Eureka Bullion

A NEW BODY of copper-gold ore has been opened up on the 1,200 level of the Eureka Bullion property of Chief Consolidated Mining, at Eureka, Utah. The ore measures 20 ft. on one side of the drift and 12 ft. on the other.

Chief Consolidated's Tintic Bullion property is producing a good tonnage of zinc-silver-lead ore from the new stope on the 900 level, and the Eureka Lily is making regular shipments of ore carrying a high lead content.

Arizona-Bagdad Buys Equipment From Monte Cristo

ARIZONA-BAGDAD COPPER has purchased a double-drum Allis-Chalmers hoist and a 1,500-cu.ft. Sullivan angle compound compressor from the Monte Cristo mine, as well as some other machinery, and will install it at its mine at Hillside, Yavapai County, Ariz. All of the machinery is in good condition, and most of it was not used at the Monte Cristo, which shut down in December, 1927, after a brief career.

At Hillside, the new shaft is down 280 ft. The mill is producing about 600 lb. of copper daily. The process consists of roasting, agitation in solution, and electrolytic precipitation.

Magnetic Mining Strikes Vein

Magnetic Mining, which is developing an exploration lease held by Tri-State Mining near Stotts City, Mo., in the Tri-State district, has struck a rich fissure vein of lead-zinc ore. The face of the strike, on the 150 level, was 30 ft.

Commerce M. & R. and Mid-Continent L. & Z. Buy Anna Beaver and Lawyers

TWO Tri-State district mines, valued at more than three-quarters of a million dollars, were sold at the beginning of this month. Frank Childress and associates have purchased for a consideration of $350,000 the holdings of Lawyers Mining, consisting of a 90-acre lease equipped with two concentrators, and a 160-acre lease, in the northwest extention of the Picher district. The Mid-Continent Lead & Zinc Company has been formed to operate and develop the properties. George Pearson, of Miami, is part owner and manager of Lawyers Mining.

Commerce Mining & Royalty has purchased the Anna Beaver mine, located near Cardin, Okla. The Anna Beaver lease consists of 200 acres. The mine, a property of Harry Payne Whitney, has been one of the largest producers in the Tri-State district for a number of years. In the last seven years the mine has produced more than 100,000 tons of zinc concentrates and about 40,000 tons of lead concentrates, and has netted Mr. Whitney several million dollars.

Both the Lawyers and Anna Beaver mines have been closed by the new owners. Extensive repairs will be made to the Lawyers No. 2 mill, which will be reopened Sept. 1. It is thought that the Commerce company will make arrangements to mine an 80-acre lease adjoining the Anna Beaver over the Anna Beaver lease, which includes a large and up-to-date plant.

Stuart, James & Cooke, Inc. to Represent Foreign Interests

ANNOUNCEMENT has been made of the establishment of an association of the firm of Stuart, James & Cooke, Inc., 17 Battery Place, New York City, and Bewick, Moreing & Company, 62 London Wall, London, by Charles E. Stuart, who returned a few days ago after four months' absence in England, France, Germany, and Russia. James H. Pierce will make his headquarters hereafter at the office of Bewick, Moreing & Company, as the London partner of Stuart, James & Cooke, Inc. Dr. Adolph Krummer, consulting engineer, Berlin, for some years associated with the Deutsche Bank, of Berlin, in the capacity of consultant, and during the war in charge of western German metal mines, has also become associated with Stuart, James & Cooke, Inc., as has Wallace Clark, noted management and production expert of Paris and Warsaw. Mr. Clark was a member of Dr. Kemmerer's commission to Poland of several years ago to reorganize Polish finance and industry.

The principal associates in the firm are: Charles E. Stuart, who, during the late war, was a member of the National Production Committee of the United States Fuel Administration and director of the National Power Conservation Campaign; James H. Pierce, for many years operating and engineering executive of the Thorne, Neale interests; C. C. Morfit, operating executive of Solvar Collieries Company, and later executive secretary of the Tug River Coal Operators' Association; Samuel H. Dolbear, consulting engineer, for many years located in San Francisco, and specialist in non-metallic minerals; Colonel C. T. Starr, formerly associated with the Weston-Dodson Company, later in charge of the mining department of the National Chamber of Commerce of the United States, and then operating vice-president of the Pittsburgh Terminal Coal Company; P. D. Browning, for many years with the Berwind-White interests and now professor of mining engineering at Columbia University and associate consultant; Carel Robinson, who for many years has specialized in mine management work; and Lucien Eaton, associated with Cleveland-Cliffs Iron Company, who recently sailed for South Africa, where he will plan the mining system of the Roan Antelope Copper Company.

Stuart, James & Cooke, Inc., have been conducting an extensive program in Russia for the last three years in connection with the coal and iron resources of that country and were one of the first organizations to go into Russia following the revolution.

New £7,500,000 Smelting Company in Britain

FORMATION of a new smelting company, with a capital of £7,500,000, to be known as the Imperial Smelting Corporation, has been announced by Sir Robert Horne, chairman of the National Smelting Company, at the annual meeting of his company held recently in London.

The new company, according to the plans outlined, will include the Burma Corporation, Broken Hill Group Zinc Corporation, British Metal Corporation, and the National Smelting Corporation. Necessary additional capital, to be issued soon, will be offered first to preferred and common shareholders of the companies involved in the merger. To protect British Empire interests, all foreign shareholders are excluded from voting power.

Union Copper Organized to Operate Tepezala Mines

HENRY WYMAN has taken a 25-year lease on the Tepezala mines and the standard-gage railroad leading to them in the State of Aguascalientes, Mexico, the property of the Guggenheim smelting interests. To operate the mines and railroad the Union Copper Company, S. A., was formed in Aguascalientes, with headquarters at Tepezala.

Power will be purchased from the Minerva Mining Company, S. A., and erection of the transmission line, 7 kilometers in length, has been started to connect the properties. A large force of men has started to grade the mill site and to do other surface work. A Whitcomb locomotive has been ordered, and is en route, which will make the operations of the railroad independent of the National Railroad in emergencies.

The mill will have a minimum capacity of 300 tons of copper-silver ore daily and will comprise the first unit of the plant planned for the property.

E. J. Harrison has been appointed construction engineer. E. G. Hill, of Pittsburgh, and W. H. Crago, of Duluth, have reported favorably on the mine.

New Goldfields of Venezuela Makes Slow Progress

CONSTRUCTION of the mill and power plant of New Goldfields of Venezuela, Ltd., in the State of Bolivar, Venezuela, has progressed more slowly than was anticipated. Transport difficulties, particularly the sinking of lighters carrying supplies, and the lack of skilled labor and manufacturing resources have been impediments. It is now hoped that two units of the power plant will be completed by September, and the whole plant by November.

The pilot mill was in operation throughout 1928, and treated 16,000 tons of ore, averaging $15 per ton. Extraction was 94.7 per cent, a figure which augurs well for the success of the new mill, now under construction, which will treat 350 tons daily.

Tri-State Mines Report Good Safety Record

SEVEN mines of the Tri-State district have worked seven months of 1929 without a lost-time accident. The mines follow: Beaver, Grace Walker, Jay Bird, Scammon Hill, Wilbur, and Webber mines of Commerce Mining & Royalty, and Mine No. 24 of Evans-Wallower Lead.

Fifty-three mines of seventeen companies reporting to the accident prevention division of the Tri-State Zinc and Lead Ore Producers' Association worked through July without a lost-time accident. These are as follows: 10 mines of Commerce M. & R.; 8 mines of Eagle-Picher Lead; 5 mines of Evans-Wallower Lead; 4 mines each of Missouri-Kansas Zinc and Century Zinc; 3 each of Consolidated Lead & Zinc and New Chicago Mines; 2 each of American Zinc, Cortez-King Brand, Federal M. & S., St. Louis S. & R., Vinegar Hill Zinc, and Canam Metals; and 1 mine each of Interstate Lead & Zinc, Skelton Lead & Zinc, Smith, Davis & Company, and Pioneer Lead & Zinc.

Butte Miners' Field Day Attracts Large Crowd

A CROWD estimated at fully 25,000, assembled from all over Montana, attended the twelfth annual Butte Miners' Field Day, held at Columbia Gardens, Butte, on July 29. Despite a broiling sun, the large crowd found much to enjoy in the long program of athletic events, mining contests, prize exhibitions, and just plain amusement.

The first-aid contest, to determine the champion team of Montana, was won by the Leonard crew, of Butte. Among a field of six teams, that crew defeated the representatives of the Great Falls zinc mill, present national champions, by the margin of one point, 485 to 484. All the teams were very well trained, about as good as a team can become, according to W. D. Ryan, U. S. first-aid and mine safety commissioner. This is the third victory gained by the Leonard team. They will represent Montana in the national contest, to be held at Kansas City in September.

John Espeland, of the Steward mine, Butte, won the individual mucking contest from the largest number of participants ever entered in the contest. There were 43 entrants, and 30 finished the difficult test of loading 1,000 lb. of oiled rock. Espeland, who is 40 years old, was champion in 1925 and 1926, and runner-up in 1921 and last year. W. R. Smith, of the Badger mine, was second. The winner's time was 1:46⅕, three seconds slower than the record.

Penn Mining Sued for $9,000,000 Encroachment

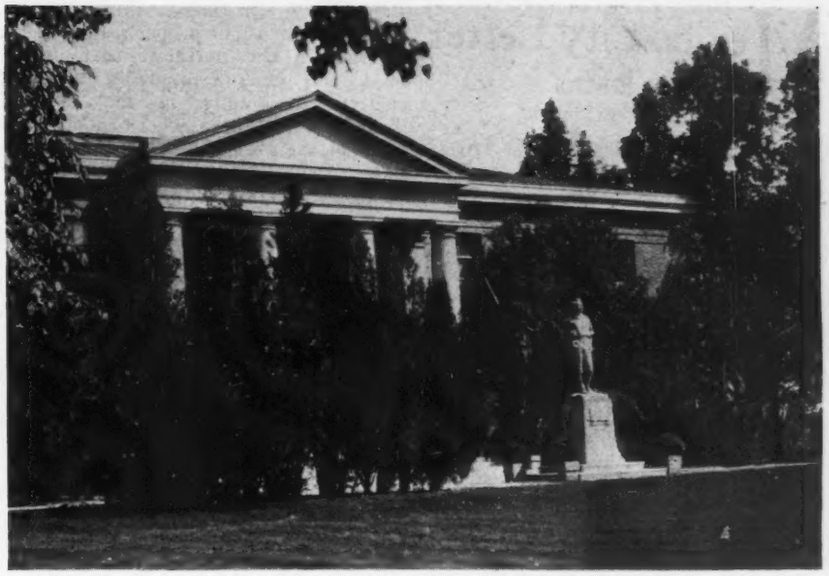
Suit for $9,000,000 has been brought against the Penn Mining Company by Mary G. Philson. Encroachment on a property in Calaveras County, Calif., is the alleged cause of action.

Penn Mining has been idle since 1919, but was in continuous and profitable operation for nineteen years before that date. From 1912 to 1919, 27,000,000 lb. of refined copper was produced. Penn ore was also rich in silver, zinc, and gold.

Bureau of Mines Starts Potash Study With Economic Survey

TO GUIDE the Bureau of Mines in its technical investigations for the discovery of processes for the recovery of potash, as contemplated in the Winter act appropriating funds for that purpose, J. R. Thoenen, one of the Bureau's mining engineers, is preparing a report on the economic conditions surrounding the sources of potash ores. Mr Thoenen has just returned from an extensive survey of such areas in the West.

As the question is whether it would be practicable to build an industry on these potash resources, the Bureau felt that before proceeding with its technical investigations it would be wise to determine how development work would be affected by the extent and richness of the orebody, its accessibility and other factors. Otherwise, the Bureau might spend much time and money in technical research that could not meet with success because of the limitations imposed by economic conditions.



The Mackay School of Mines, Reno, Nev.

Mackay Gives $500,000 to University of Nevada

CLARENCE H. MACKAY, already a generous benefactor of the University of Nevada, has given the institution $500,000 more. The last gift is to establish the Mackay Science School, in memory of his father, John W. Mackay, pioneer miner. Mr. Mackay and his mother have now given a total of $1,500,000 to the Nevada school. The previous donations, dating from 1907, include the Mackay School of Mines and endowments therefor, the Mackay Athletic Field, and the Mackay Training Quarters.

The Science School, which is expected to be completed by the autumn of 1930, will offer instruction in chemistry, physics, and mathematics. These studies are basic to and will supplement the work of the School of Mines.

John W. Mackay was a pioneer in the development of Nevada and California gold and silver fields. He opened up many silver mines along the Comstock Lode, and in 1873 discovered the famous Big Bonanza mine. Later he founded the Postal Telegraph and Commercial Cable System, of which his son is now president. Among other donations, Mr. Mackay has also given $100,000 to the University of California as a memorial to his father.

Texas Iron Property Reverts to State

Iron ore lands and a furnace, at Rusk, Cherokee County, Tex., have reverted to the state. The property was sold by the state ten years ago to P. P. Featherstone and associates. Failure to meet payments caused District Judge George Calhoun, of Austin, to declare the title forfeited. The state operated the property for some years by convict labor, but at a loss. The land will probably remain idle.

California Miners Will Meet

The Northern California Mining Association will hold a meeting at Yreka, Siskiyou County, on Aug. 24. At this gathering it is planned to form a statewide mining association, preliminary steps for which were taken at Weaverville in June.

L. S. M. I. Holds Annual Meeting Sept. 6 and 7

THE annual meeting of the Lake Superior Mining Institute will be held in the Michigan copper district this year, Sept. 6 and 7. A large delegation of mining men and their ladies from the mining regions of Michigan, Wisconsin, and Minnesota is expected. The program is now in course of preparation. Papers pertaining to various phases of the copper and iron mining industries will be presented at the business session on the evening of Sept. 6. There will be visits to mines, mills, and smelters of the district and various other features of entertainment.

W. H. Schacht, general manager of Copper Range, is president of the Institute. The program is being arranged by Harry Vivian, chief engineer of Calumet & Hecla; John M. Wagner, assistant treasurer of Copper Range; C. H. Baxter, head of the department of mining of the Michigan College of Mining and Technology; and Theodore Dengler, general manager of Mohawk. A. J. Yungbluth, of Ishpeming, is the secretary.

Mexico City Letter

By W. L. Vail

Special Correspondent

Completion of Railways Spurs Activity in Chihuahua—Boleo Strike Quiescent

Mexico City, Aug. 3, 1929.—Completion of the Kansas City, Mexico & Orient Railway into Ojinaja, on the border of the Rio Grande, has had the immediate effect of stimulating mining activity in the northeastern portion of the State of Chihuahua. Notable among the old properties at work again is the Valverde, 50 kilometers from Ojinaga, in the Sierra Rica mountains. This company is reported to have recently installed machinery to the value of $100,000 and to be preparing to install $200,000 worth more. It is also reported from Ocampo, west of the city of Chihuahua, that an American concern has acquired ownership of the old Matulera properties, at one time one of the big bonanza workings of the state.

CONDITIONS at El Boleo, Lower California, where a strike is on at the mines of the Boleo company, remain practically quiescent at this date. No acts of sabotage of importance have been committed, and the federal government appears to be maintaining a waiting attitude, prepared to repress by force any overt acts of disorder or destruction on the part of the strikers. Output at Boleo for the first six months of this year is reported at 3,030 tons, the ore averaging 3.88 per cent copper.

Reports from Zacatecas indicate that the mining situation is fairly normal. A number of small properties are being worked in the northern part of the state and exploration work is being undertaken quietly in the city of Zacatecas and suburbs. President Sanborn of the Pittsburg-Vetagrande company recently made a visit of inspection of the properties of his concern. It is stated that the company is planning to bring in power from Irapuata, a distance of some 200 miles. Installation work would require the best part of a year. The company may, however, decide to install turbines.

La Dura Mining, in Sonora, has increased the number of day miners to over 500, and it is reported that the company expects to add still more to the payroll within the next 60 days. A number of small properties in the vicinity of La Dura are also being put in condition to work.

The Minera y Beneficiedora de Inde, Durango, has recently installed a 400-hp. Diesel engine, and is milling 100 tons of gold ore daily. Gordon Wilson is manager. Richard Tighe, manager of the Magistral mine, is preparing to pump out the water and open up a body of ore for extraction at Colorado, Durango, one of the properties of the old Lustre Mining Company. A steam plant is being erected at San Francisco del Oro, Chihuahua, on account of shortage of water at Boquillas Dam. This shortage has become a serious menace to mining interests in parts of Durango and Chihuahua.

A new mining district was created for the State of Sinaloa, effective Aug. 1. Heretofore all mine operations, denouncements, and the like for the State of Sinaloa had to be filed in Mocorita, Sonora.

Gold Again Sought in Western Australia

EXPEDITIONS have been revisiting Tanami, in the Northern Territory of Western Australia, according to advices reaching London. During the boom period of Westralian gold mining, prospectors penetrated to Tanami, and reported very favorable indications of gold. A large company was floated, but nothing ever came of the enterprise. Revival of interest in the region is attracting considerable attention.

Manitoba Tin Discoveries Are Being Developed

DEVELOPMENT work on the tin properties of Jack Nutt Mines, Ltd., in the Herb Lake district of northern Manitoba, is making good progress. The company owns upward of 200 claims. At the Bernic Lake group, which is the main camp, a complete mining plant has been installed, and a 10-ton test mill is working at capacity. An assay plant has also been established. The shaft is down 125 ft. and crosscutting at this horizon has encountered good ore. The shaft is to be deepened to 175 ft.

On the Rush claims the crosscut is not yet on the main shoot. A pegmatite dike 3 miles long and 200 ft. wide has been discovered, on which about a mile of cross channeling has been done. On this group there is also a rich showing of zinc. On the Bird Lake group four diamond drills are in operation, all being down to the 250 level, running through garnierite carrying good amounts of tin. The Bird Lake group has also shown copper deposits of fair grade. A group owned by Stannite, adjacent to the Rush, has produced some favorable results, and work is being carried out to ascertain the dimensions of the orebody, which dips into the Rush group.

The company has completed the purchase of 144 claims of the Apex group, on Herb Lake, said to be good gold properties, and the Tremblay-Olson group, in the Rotten Stone Lake district.

Sherritt-Gordon Construction Is Running Ahead of Schedule

THE EFFORTS of the management of Sherritt-Gordon Mines, Ltd., in the Flin-Flon district of northern Manitoba, are at present being concentrated on mill construction. It is expected that the railway will reach the mine about the middle of August, about five months ahead of the scheduled time, thereby securing a bonus of $100,000 for the contractor. All the machinery for the 1,500-ton mill has been ordered and will be brought in as soon as possible. It is now hoped to have the steel work completed before the cold weather sets in, and to carry out the installation of the machinery during the winter months.

Underground work is not being pushed at present. Lateral work from the two shafts has advanced far enough to put in sight about $150,000,000 in ore in the area so far opened up. A third shaft is now being put down on the Ook claims, well to the west of the central shaft, to open up the orebodies, indicated by diamond drilling to be of equal size and greater average richness than those being opened up in the central and eastern workings.

Two of the company's engineers have just completed an extensive tour investigating plants in British Columbia and the United States, and their most modern features will be incorporated in the Sherritt-Gordon mill.

Tampico Ore Shipping Facilities Are Increased

Capacity for ore shipments at Tampico, Mexico, has been increased potentially 20 per cent by the extension of the ore wharf 211 ft. The construction, by the National Railways of Mexico is complete, and the pier is in full operation. Construction of an ore elevator, to facilitate the loading of minerals, especially concentrates, will be started soon.

Bennett-Pacaud Will Mine

Exploration at Bennett-Pacaud Mines, Ltd., in the Sturgeon Lake district of northern Ontario, has been so encouraging that a mining plant will be installed immediately. The initial objective of shaft sinking will be 100 ft., from which depth lateral workings will be driven to explore the veins. Channel sampling on the No. 1 vein, which outcrops over a length of 600 ft., has disclosed gold-bearing ore of good grade 2 to 4 ft. wide over a length of 60 ft. Diamond drilling will also be undertaken.

Utica Mines Reopens

The Utica mine, at Paddy's Peak, in the Slocan district of British Columbia, has begun actual mining operations. No. 5 level is being driven to intersect the east and west veins, estimated at a distance of 100 and 300 ft., respectively. In the past the mine has yielded 5,000 tons of rich silver-lead-zinc ore.

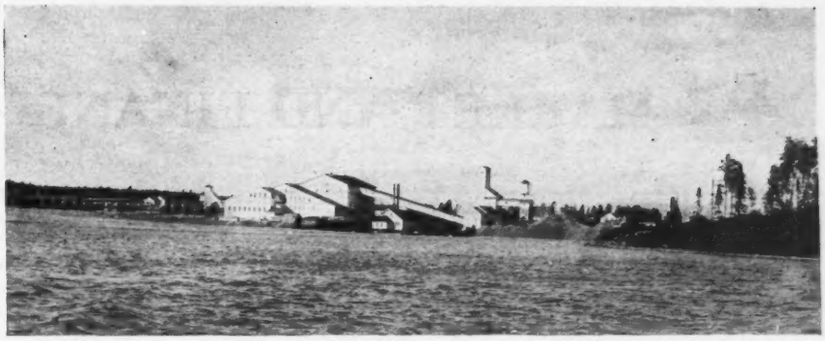
Toronto Letter

By Our Special Correspondent for Northern Ontario

Waite-Ackerman-Montgomery and Amulet Discover New Orebodies

TORONTO, Aug. 3, 1929—During the last year practically all new copper discoveries of importance in the Rouyn district have been made at the Noranda, but within the last few weeks new orebodies have been proved at both the Amulet and the Waite-Ackerman-Montgomery. After almost two years of drilling on the Amulet, with meagre results, two diamond-drill holes have shown 21 and 35 ft. respectively of ore rich in copper and zinc. The deposit, which lies 250 ft. below the surface, appears to be a flat formation. To date only two intersections have been cut, but two drills have been moved over to this section, and further information should be available soon.

DIAMOND drilling on the Waite has proved the existence of three new high-grade copper bodies, which lie approximately 500, 600, and 700 ft. below the surface. To develop them it will be necessary to continue the shaft below the present 300 level, and this work will be started as soon as possible. A drill hole through the upper body showed 41 ft. of ore assaying 6.75 per cent copper, and drilling to date indicates an average of 6 per cent copper over widths of 33 to 51 ft. for a length of 200 ft. The center body gave one intersection of 8 ft. running 5 per cent copper and another of 16 ft. running 5 per cent. The last hole drilled through the lower body gave an average of 15 per cent over 5 ft., with lower-grade ore over larger widths in other holes. Waite is now making a substantial profit from shipments of ore to the Noranda smelter.



The Wright-Hargreaves mine, in the Kirkland Lake District

In Cadillac Township, which lies to the east of Rouyn, spectacular gold ore has been found on the Pandora property. Three trenches 60 ft. apart have all shown ore rich in free gold. The main workings of the property were concentrated on an ore zone 1,000 ft. to the south of the new showing. A shaft was sunk, but the results were erratic and rather disappointing.

Wright-Hargreaves mine, in the Kirkland Lake district, is gradually working itself into an improved position. Operating at 400 tons a day, a profit of approximately $30,000 a month is being made. Through mining narrower widths the grade has been brought up to $9 per ton. An extensive program of development and exploration is under way, only half of the machines underground being in the stopes. Favorable results have been encountered in the eastern section of the mine. During the next year it is proposed to concentrate on development and exploration rather than to work for increased production. The company has almost $1,000,000 in the treasury and is in good financial condition to carry through this program.

Plans Are Announced for Owen Lake Development

FOLLOWING the sale of a controlling interest in Owen Lake Mining & Development to Noah Timmins, plans have been made for a rapid development of the Owen Lake mine, near Smithers, B. C. The long crosscut tunnel, now at about 500 ft. depth, will be extended as fast as possible. The tunnel still has 600 ft. to go before entering the vein system on the Wrinch claims. Nine well-mineralized veins have already been traversed on this tunnel. When the Wrinch orebody is reached, sinking in the first series of veins near the portal will be carried out.

Work at the surface is also active. A sawmill is being prepared for operation, to cut lumber for construction of shelters and a commissary for the increased number of men to be employed. A. Greenland has been made managing director of the company, and F. H. Taylor is president and resident manager in charge of operations.

McGinn Commences Drilling

Diamond drilling with two drills has been started on the McGinn property in Baldwin Township, in the Sudbury district of northern Ontario, held under option by T. H. Rea, of Toronto. The showing is of copper of good grade across widths up to 40 ft. over a known length of 1,200 ft.

Geduld Opened Little Ore

Geduld Proprietary Mines, Ltd., a leading gold producer on the East Rand, Transvaal, during 1928 sampled 2,300 ft. of new ground. Of this, only 375 ft., or 16.3 per cent, proved payable ore. Developments were, however, mostly exploratory in character.

N'Kana Ore Reserves Now Estimated at 42,000,000 Tons

THE estimated ore reserves of the N'Kana property of Bwana M'Kubwa Copper, in Northern Rhodesia, now amount to 42,000,000 tons, according to figures released at the annual stockholders' meeting. The southern section of the orebody now has a proved length of 5,000 ft., not limited at either end, and an average true width of 20 ft. This contains 6,000,000 tons of ore, averaging 3.1 per cent copper. The northern section has a length of 7,900 ft. and a width of 29 ft., and contains 36,000,000 tons of ore averaging 4.4 per cent copper. Of this, 32,500,000 tons is clean disseminated ore.

Drilling at N'Kana during 1928 totaled 25,789 ft., and operations this year up to July 20 comprise 10,264 ft. of drilling, making a total for the property of 40,100 ft. This is said to be a record for Northern Rhodesia.

At the annual meeting Sir Edmund Davis announced that, owing to the exercise by Roan Antelope Mines of its option on the Roan Extension property, in which Bwana had an interest, Bwana M'Kubwa has acquired 50,000 fully paid shares in Roan Antelope.

RHODESIAN DRILLING RESULTS

ROAN ANTELOPE MINES reports that drill hole No. 3 of its Roan Extension property has cut two separate orebodies. The first was at depth 391.5 ft., and showed true width of 26.95 ft. of sulphide ore, averaging 2.71 per cent copper. The second, at 449.4 ft., showed true width of 22.7 ft., averaging 5.21 per cent copper. As core recovery was low, being 62.6 per cent from a depth of 391.5 to 432.5 ft., and only 8 per cent from 449.4 to 481.5 ft., results will be checked by diamond drilling. Hole No. 3 is near the western boundary of the Extension area, being 1,000 ft. northwest of hole No. 9, which, at 560 ft. depth, showed 32 ft. of ore averaging 3.50 per cent copper.

Roan Antelope hole No. 31 has cut the orebody at a depth of 1,743 ft. It shows true width of 20.5 ft. of sulphide ore, averaging 3.16 per cent copper. Depth and grade are about what were to be expected, as may be seen by comparing the results for the adjoining holes Nos. 34 and 48, as given in the table on p. 970 of *Engineering and Mining Journal* for June 15. Hole No. 31 showed a thickening of the orebody.

MARKET AND FINANCIAL NEWS

Stocks of Zinc in European Countries Above Average of Recent Years

By International Metal Service, London

THE first half of the year closes in rather an unsatisfactory position so far as zinc is concerned in Europe. Though in America accumulated stocks have been coming down, the contrary has been the situation in the Old World, and stocks at the moment in Europe are higher than at any time for several years. The slightest pressure to sell on the London Metal Exchange suffices to mark down quotations, and it is probably this factor more than anything else which gives rise for dissatisfaction among some of the smaller members of the cartel.

The figure which the sponsors of the European cartel aimed at as the intrinsic value of G.O.B. zinc was £27: hence the disappointment among certain of its constituent members that the present selling price should be very little over £25 per long ton.

Perhaps it is not too much to hope that as a result of the setback good may come, in that it may lead to a closer association among producers and thus to a consequent better control over markets.

Whether the cartel acted wisely in not ordering a further curtailment in production a few weeks ago has been hotly debated ever since in metal circles. Unless the situation improves in the interim, the Council may determine upon an additional "cut" in output, commencing two months hence.

The severe winter undoubtedly contributed to the present discouraging position, inasmuch as the immobilized stocks have only now been dispersed. Meanwhile, consumers in Central Europe who had bought metal other than what they would have ordinarily taken have now to take zinc under old contracts, and naturally fresh production is finding the greatest difficulty in securing a home.

The months of August and September do not stand out for high consuming capacity, and it thus cannot surprise anyone if the present dullness prevails for another two months anyhow. But if the cartel at its next meeting decides to restrict production still further, sentiment will improve and the way will be paved for a market recovery to over £26.

We estimate world stocks of slab zinc on Aug. 1, as follows:

	Metric Tons.
United States	39,900
Canada, including afloat	3,800
Germany-Poland	12,500
Belgium	9,400
France	1,500
Great Britain	1,500
Other Europe	1,700
Australia, including afloat	4,000
Far East	1,000
Elsewhere	2,000
Total	77,300

Crude Arsenic Production Off in First Half of 1929

PRODUCTION of crude arsenic in the United States in the first six months of 1929 totaled 9,247 tons, which compares with 9,860 tons in the corresponding period last year, according to the American Bureau of Metal Statistics. Production of refined arsenic in the first half of the current year amounted to 5,290 tons, against 4,297 tons in the January-June period last year. Stocks of crude on June 30 were placed at 2,161 tons, against 2,099 tons a year ago. Stocks of refined arsenic on the last day of June amounted to 3,709 tons, which compares with 1,926 tons on June 30, 1928.

Imports of white arsenic during June amounted to 1,606 short tons, of which total Mexico supplied 1,456 tons, Canada 94 tons, Belgium 50 tons, and Germany 6 tons. Imports for the first six months of 1929 amounted to 6,936 tons, compared with 6,004 tons for the similar period in 1928.

Golden Cycle Mining & Reduction Company stockholders, at a special meeting held in Denver July 6, voted in favor of the proposed merger of their company with the Cripple Creek Central Railway, holding company for the Midland Terminal, and the United Gold Mines Company. The new company will be known as the Golden Cycle Corporation. There is to be no change in the management.

Iron Ore Production in Minnesota for this season to July 1 was 15,670,744 tons, with indications that a new production record will be established by the end of the season. For the similar period last year 10,082,900 tons had been mined. The figures are based on royalty payments to the state.

Second Quarter Earnings of Granby Higher

GRANBY Consolidated, Mining, Smelting & Power Company, Ltd., for the quarter ended June 30, 1929, reports profit of $1,164,813 after expenses and ordinary taxes but before depreciation, depletion, and federal taxes, comparing with $940,364 in the preceding quarter and $747,609 in the second quarter of 1928. The company has outstanding 450,000 shares of $100 par stock.

Profit for the first half of 1929 totaled $2,105,177 before depreciation, depletion and federal taxes, against $1,301,214 in the first six months of the previous year.

Production of copper in second quarter of 1929 totaled 15,480,514 lb., a monthly average of 5,160,171 lb., compared with 14,904,806 lb. in the first quarter, a monthly average of 4,968,269 lb.

Net cost of producing copper in the second quarter, including all operating and general charges and crediting precious metals and miscellaneous income to copper, was 10.94c. a pound, compared with 9.97c. in the first quarter of the year. These costs are before depreciation, depletion, and income taxes. Unsold copper is being carried in the inventory at 13¼c. a pound.

Seneca Copper Production Gains in June Quarter

SENECA Copper Mining Company reports for the quarter ended June 30, 1929, a loss of $25,328 after expenses and charges, including capital expenditures but before depletion and depreciation. This compares with a loss of $54,126 in the preceding quarter. Copper production in the June quarter amounted to 895,544 lb., comparing with 243,257 lb. produced in the preceding quarter.

Income account for the quarter ended June 30, 1929, follows: Copper produced, $160,858; miscellaneous income, $5,852; total income, $166,710; operating expenses, $150,924; operating profit, $15,786; capital expenditures, $41,114; loss before depreciation and depletion, $25,328.

Central Manitoba Mines treated in June last 4,550 tons and recovered $33,322, an average of $7.32 per ton. For the fiscal year ended April 30, production was $508,000, and all expenses, including development, amounted to $521,000, a loss of $13,000 for the year.

London Financial News

By W. A. Doman
Special London Correspondent

London, July 23, 1929.—Little has been heard lately in mining circles of the Panama Corporation. That, however, does not mean that nothing has been done. Hugh F. Marriott, one of the directors, is actively engaged on this side in selecting the type of machinery that will prove most useful. Last week he spent two days inspecting various machinery makers' works, and he has, I believe, decided upon a type of Diesel engine that can be used in the initial stages of work. Meanwhile exploration is going forward, and assays are being made in London.

The Zinc Manufacturing Company, a new undertaking, has already got one plant unit in operation. The work on six new plants is well under way, and they are expected to be in operation in the near future. Plants are expected to be erected in Tunis. Stewarts & Lloyds are interested in the enterprise. In the second year an output of 50,000 tons of spelter is looked for.

Tin keeps strong on quiet buying, and the spot price has risen to £214 17s. 6d. Nothing further has been heard of the Tin Producers' Association; critics assert that unless Chinese producers and Bolivia join in, any attempt at regulating the output must fail.

A Tin Applications Committee has been formed for the purpose of organizing research into improved commercial applications of tin and the discovery of new uses for the metal. Sufficient money has been guaranteed to cover the outlay on a program of research for two years ahead. This work has been placed under the supervision of the British Non-Ferrous Metals Research Association, a body supported by government grants, and in close co-operation with the National Physical Laboratory, Woolwich Arsenal. The object is to collect and disseminate knowledge of the properties of metallic tin. As the idea is to increase the uses of tin, the possibility of earlier exhaustion of supplies does not seem to be worrying the producers.

Zambesia Company Declares Regular Dividend

Zambesia Exploring Company, Ltd., reported profit for the year of £112,453, as compared with £184,767 in the preceding year. Sir Robert Williams, managing director, at the general meeting held in London July 25, said that the issued capital remained at £865,083, and the reserve account was now £435,000, as against £450,000 for the previous year.

The company, he pointed out, was in a very strong financial position, with large reserves and cash assets, the quoted securities, together with cash and investments and loan to brokers, representing, at current market prices, about £2,500,000. The directors felt justified in recommending the same dividend as last year—namely, 10 per cent—with a bonus of 10 per cent, both less tax, making a total for the year of 20 per cent.

Calumet & Hecla Profit Up in Second Quarter

Calumet & Hecla Consolidated Copper Company reports for quarter ended June 30, 1929, a net profit of $1,841,766 after taxes and depreciation, but before depletion, equivalent to 92c. a share earned on 2,005,502 shares of stock, comparing with $1,800,358, or 90c. a share, in the preceding quarter. In the June quarter of 1928, net profit after taxes, depreciation, and depletion amounted to $744,523. Net profit for the first half of 1929 totaled $3,642,124 after taxes and depreciation, but before depletion, equal to $1.82 a share.

Income account for six months ended June 30:

	1929	1928
Receipts:		
Copper sales	$11,003,038	$8,391,482
Interest	94,977	57,715
Miscellaneous	7,275	4,982
Total receipts	$11,105,291	$8,454,178
Disbursements:		
Copper on hand at beginning of period	$2,115,276	$3,650,171
Producing, selling, administration and state taxes	6,425,743	5,636,892
Depreciation and depletion	1,951,115	1,813,895
Miscellaneous	110,628	57,779
Total expenditures	$10,602,762	$11,158,737
Less copper on hand June 30	1,974,659	3,761,277
Net expenditures	$8,628,103	$7,397,460
Profit for period	2,477,185	1,056,721

Park Utah Profit Lower In First Half of Year

Park Utah Consolidated Mines Company for the first half of 1929 reports profit of $217,090 after depreciation and ordinary taxes, but before depletion and federal taxes. This compares with a profit of $449,867 in the first six months of 1928. The low price of lead and silver affected the gross receipts and was an important factor in reducing earnings in the current year.

Income account for six months ended June 30, 1928 and 1929, is as follows:

	1929	1928
Total income	$1,466,835	$1,676,930
Exp. and ord. taxes	1,193,401	1,144,110
Depreciation	56,344	59,305
Other charges	.....	(b) 23,648
(a) Profit	$217,090	$449,867
Dividends	837,400	837,400
(a) Deficit	$620,310	$387,533

(a) Before depletion and federal taxes. (b) Additional federal taxes for prior years and interest.

Evans-Wallower Lead Company profit for the six months ended June 30, 1929, totaled $311,445 after depreciation, but before depletion and federal taxes, comparing with $145,796 in the first half of 1928.

Anaconda Wire Acquires Marion, Indiana, Company

Anaconda Wire & Cable Company, a subsidiary of Anaconda Copper Mining, has acquired, for 7,455 of its shares and $425,000 in cash, the property and assets of Marion Insulated Wire & Rubber Company, an Indiana corporation. Marion Insulated Wire & Rubber Company was incorporated in 1903. Its business consists of the manufacture of insulated wires and cords of all types. Its three plants are in Marion, Ind.

North Lily Mining Company for the second quarter of 1929 reports net earnings of $1.32 a share, as compared with dividend requirements of $1 a share per year. Gross output for the same period amounted to $468,383, as compared with $526,095 for the first quarter. Operating profit totaled $270,581, and net income, after federal taxes and all expenses, was $266,590, as compared with $346,429 for the first quarter. Shipments for the quarter totaled 17,091 tons of ore.

Tavoy Tin Dredging Corporation, Ltd., London, reports net profit for 1928 of £52,832. Total dividend paid for the year was 20 per cent, free of tax, equivalent to a gross return of 25 per cent. In view of the fall in the price of tin, the showing for the year was regarded as satisfactory, even though not quite up to the previous record. During the five years of the company's existence it has paid out 131 per cent in dividends, free of tax, which amounts to 165 per cent gross.

United States Steel Corporation and subsidiaries report for quarter ended June 30, 1929, total earnings of $71,995,461 after expenses, federal taxes, and interest on bonds of subsidiaries, but before depreciation. This compares with $60,105,381 in the preceding quarter and $46,932,986 in the second quarter of 1928. Net earnings for six months of this year were $132,100,842, against $87,867,018 in the same period last year, and $91,625,185 in 1927.

Walker Mining Company, operating at Spring Garden, Plumas County, Calif., made a net profit of $478,207 before depreciation for the first six months of the year. This is at the rate of 55c. a share. On June 30, the company's indebtedness to the International Smelting Company was reduced to $410,000. By the first of the year, the company expects to be out of debt, since it is paying off its note at the rate of $65,000 to $90,000 a month. The new unit of the mill, which will increase capacity from 1,200 tons daily to 1,600 tons, should start operations about Aug. 15.

German Potash Sales for the first six months of 1929 totaled 829,996 metric tons, against 802,978 tons in the corresponding period last year and a total of 715,094 tons in the first half period of 1927.

The Market Report

Copper and Lead in Excellent Demand

New York, Aug. 7, 1929—A brisk demand for both copper and lead was the feature of the non-ferrous metal markets in the week ending today. Zinc, tin, and silver were all quiet; and no price changes of importance were registered for any of the metals.

Copper Activity Increases

For the fifth successive week, the volume of copper sales has increased, the total domestic business reported since last Wednesday being in the neighborhood of 17,000 tons, which, with the foreign sales of over 12,000 tons in the same period, makes a most satisfactory showing for the first week of August. As a result of the week's activities, the custom smelters are in a uniformly satisfactory position, and are willing to share some of the business with the larger producers who have so long been cooling their heels on the sidelines. These larger interests have not yet taken any important share in the market, but will gradually take over their part of the burden of supplying consumers' demands.

As in the weeks immediately past, the principal demand has been for prompt shipment. August has been specified for about 55 per cent of the business, leaving about 30 per cent of the demand for September and 15 per cent for October. Brass manufacturers are showing more interest in the market, though the major part of the demand continues to come from the wire and cable people. Continued stability of the copper market at the 18c. level is evidently having the effect of re-establishing the confidence of the ultimate consumers, who are beginning to buy more freely from the manufacturers.

Rumors have been heard of a possible increase in price if a buying wave develops, but no evidence of such an intention by selling interests is apparent. And certainly there is no thought of any reduction whatsoever for some time to come.

England has been in the export market to an increased extent. The price continues at 18.30c., c.i.f. European ports.

Daily Prices of Metals

Aug.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
1	17.775	47.125	6.75	6.55	6.80
2	17.775	47.25	6.75	6.55@6.575	6.80
3	17.775	No Market	6.75	6.55@6.575	6.80
5	17.775	47.375	6.75	6.55@6.575	6.80
6	17.775	47.25	6.75	6.55@6.575	6.80
7	17.775	47.00	6.75	6.55@6.575	6.80
	17.775	47.200	6.750	6.560	6.800

Average prices for calendar week ending August 3, 1929, are: Copper, 17.775; Straits tin, 47.200; New York lead, 6.75; St. Louis lead, 6.554; zinc, 6.800; and silver, 52.583.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary forms of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Aug.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic bid						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
1	73 1/4	73 13/16	84 1/4	212 7/8	217	23 3/16	23 1/8	25 1/16	25 5/16
2	73 1/4	73 13/16	84 1/4	213 1/4	217 1/8	23 3/16	23 1/4	25 1/16	25 5/16
5	Holiday	....	....	....	....	....	....	....	....
6	73 9/16	74 3/8	84 1/4	212 3/4	216 7/8	23 1/16	23 5/16	25 1/16	25 3/8
7	73 3/4	74 3/8	84 1/4	212 3/8	216 1/4	23 3/8	23 5/16	25 1/16	25 5/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Aug.	Sterling Exchange "Checks"	Silver		Gold London	Aug.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
1	4.84 11/16	52 5/8	24 5/16	84s11 1/2d	5	4.84 5/8	52 5/8	Holiday	Holiday
2	4.84 5/8	52 5/8	24 5/16	84s11 1/2d	6	4.84 5/8	52 5/8	24 5/16	84s11 1/2d
3	4.84 5/8	52 1/2	24 5/16	.....	7	4.84 5/8	52 1/2	24 1/4	84s11 3/8d

Average: Silver, 52.583c.; Sterling Exchange, 484.635c.

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three quarters cent premium.

Good Demand for Lead

The volume of open-market lead sales to domestic consumers in the last week was the largest reported since the week ending March 6. Virtually every important consuming outlet has participated in the week's purchases, though corroding probably has been most in demand. London lead quotations have been higher during the greater part of the last week, and that factor has had considerable influence in bringing consumers into the market at the present time.

Higher prices are freely predicted before the end of the month by several trade factors, and if one is inclined to place much faith in statistics, ample precedent may be found for such predictions, inasmuch as a glance through the files reveals that *E.&M.J.'s* monthly average lead price has been higher in August than it was in July for the last eleven years, or since 1917. However, all of the week's business in the East has been consummated on the basis of 6.75c. per pound, New York, which also is the A.S.&R. Co.'s contract price. In the Middle West, considerable demand has been in evidence for September lead. Much of this business has been placed at a premium of $0.50 to $1 over the price of spot, which has been steady at 6.55c. per pound. Sales to dealers of forward lead were reported at premiums as high as $1.50 per ton.

Zinc Neglected

Sales of zinc have been confined to an occasional carload. Producers seem uniformly at the 6.80c. level, though an occasional lot of second-hand metal has been rumored to be available at 6.75c. Forward sales have not been large, so that it is expected that galvanizers must soon enter the market.

Stocks of zinc increased by a little over 7,000 tons last month, according to the American Zinc Institute's compilation. The rate of production, considering the longer month, was about the same as in June, but shipments were less. The data follow, in tons:

Stock, July 1	36,932
Produced	54,441
Shipped	47,251
Stock, July 31	44,122
Shipped from plants for export	681
Metal sold, not yet delivered, July 31	28,267
Retort capacity, July 31	120,376
Average number retorts operated, July	71,092

Tin Dull

Activity has been entirely lacking in the tin market during the last week, prices being slightly lower at the close. Consumers are showing less interest in forward positions, and as a result very little business has been consummated.

Silver Inactive

During the last week the silver market has been without feature. Fluctuations in the price have been almost negligible, and very little interest was shown by either buyers or sellers. Tendency is quiet and steady.

Mexican dollars (old Mexican pesos): Aug. 1st and 2d, 40c.; 3d, 39⅞c.; 5th and 6th, 40c.; 7th, 39⅞c.

Foreign Exchanges Quiet

Closing cable quotations on Tuesday, Aug. 6, were as follows: Francs, 3.91⅛c.; lire, 5.23c.; and marks, 23.83c. Canadian dollars, ¼ per cent discount.

Steel Production in July Close to Peak Rate

Pittsburgh, August 2, 1929

There was substantially full production of steel in July, at not more than about 5 per cent under the all-time peak rate, reached in May.

In the last two months there has been a slackening in steel buying, due largely to better deliveries and less occasion to make forward engagements.

Thus far in the year automobile production has followed its usual seasonal swing, and assuming similar adherence to precedent for the remainder of the year it will engage about 4 per cent less of the steel capacity in the second half than it did in the first half. Decrease in rail production promises to be less than usual, but will represent about 5 per cent less of the steel. As a partial offset, both structural-steel fabricating and freight-car building promise somewhat more steel consumption in the second half. Line pipe will do even better in the second half. The largest natural gas line yet has been let, 950 miles Texas to Chicago, 191,000 net tons.

Finished-steel prices continue perfectly steady except for slightly increased weakness in black and galvanized sheets and some weakness in wire nails and cold rolled strip.

PIG IRON.—Bessemer, $19; basic and foundry, $18.50, f.o.b. Valley furnaces. Southern iron has sold at as low as $14, Birmingham, against $16.50 prior to the middle of March.

CONNELLSVILLE COKE. — The market has been very dull, as is usual for July. Spot prices have held, at $2.75@$2.85 for standard furnace coke and $4@$4.25 for standard foundry coke.

Joplin Ores Unchanged

Joplin, Mo., Aug. 3, 1929

Blende	Per Ton
High	$46.65
Premium blende, basis 60 per cent zinc	41.00@ 43.00
Prime Western, basis 60 per cent zinc	43.00@ 44.00
Table concentrates, 60 per cent zinc	$41.00@ 43.00
Flotation concentrates, 60 per cent zinc	39.00@ 41.00
Average settling price, all zinc ore	43.62
Galena	
High	$87.70
Basis 80 per cent lead	85.00
Average settling price, all lead ore	86.72

Shipments for the week: Blende, 11,559 tons; lead, 1,922 tons. Value all ore the week $670,890.

The demand for zinc ore is fully up to an average, and there seems no reason for lower prices, and no lower offerings were made.

Lead ore has increased in demand and though no higher offering has been reported made, sellers are marketing this product more freely.

Platteville, Wis., Aug. 3, 1929

Zinc Blende	Per Ton
Blende, basis 60 per cent	$46.75
Lead Ore	
Lead, basis 80 per cent	$85.00

Shipments for the week: Blende, 515 tons; lead, none. Shipments for the year: Blende, 20,658; lead, 1,140 tons. Shipments for the week to separating plants, 1,556 tons blende.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c. London, 98 per cent, quoted at £95 per long ton, less 2 per cent for domestic consumption.

ANTIMONY—Per lb., duty paid: Chinese brands, for all positions, 8⅝c. Cookson's "C" grade, spot, 14c. Chinese needle, lump, 8c. Standard powdered needle, 200 mesh, 10c.

BISMUTH—Per lb., in ton lots, $1.70. Smaller lots $1.85 and up. London 7s. 6d.

CADMIUM—Per lb., 80@95c. London, 4s.@4s. 1d. for prompt.

CHROMIUM — Per lb., 97 per cent grade, $1.50.

COBALT — Per lb., f.o.b. Canadian works: Shot or rondelles, 97@98 per cent, $2.50. Contract sales booked at discounts, depending on quantity. Black oxide, 70 per cent, $2.10. London, nominal, 10s. for metal in small lots, 8s. for black oxide; 8s. 10d. for gray.

[1]GERMANIUM OXIDE—Per gram in 300- to 500-gram lots, $3.50.

IRIDIUM—Per oz., $230@$240 for 98 @99 per cent sponge and powder. London, £50.

[1]LITHIUM—Per oz., 98@99 per cent grade in 1- to 5-lb. lots, $5.

MAGNESIUM—Per lb., in ton lots, single orders for spot metal: 8-lb. ingots (3x3x15 or 16 in.), 85c.@$1.05, depending on quantity; 2½- or 3-lb. sticks (1⅜ in.), 90c.@$1.10, depending on quantity; 10-oz. sticks (1x12 in.), 80@90c. Discounts up to 20 per cent on larger orders or contracts. London 3s. 3d.@3s. 9d. for 99 per cent ingots or sticks.

[1]MOLYBDENUM—Per lb. in 1- to 3-lb. lots, 99 per cent, $18. (Usually sold as calcium molybdate or ferromolybdenum, which see).

NICKEL—Per lb., ingot 35c.; shot 36c.; electrolytic, 35c. (99.90 per cent), for single lots of spot metal. London, per long ton, £172½@£175 according to quantity. *Metal Bulletin*, London, reports no difficulty is experienced in disposing of the current output.

OSMIUM—Per oz., $58@$65; London, £12@£14.

PALLADIUM — Per oz., $38@$40. London, £7@£7 5s.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $68. Transactions between dealers and refiners in the outside market are commonly reported at several dollars less. London, per oz., £13 10s.@£13 15s. for refined; crude and scrap, nominal at £11 10s.@£12.

QUICKSILVER—Per 76-lb. flask, $124 @$125. Market firm on small offerings from Europe. San Francisco wires $123.33. London quiet, with offers of spot at £22 2½s.@£22 5s.

RADIUM — Per mg. radium content, $70.

RHODIUM—Per oz., $45@$55. Nominal. London, £10@£12.

RUTHENIUM — Per oz., $42@$50., Nominal. London £9@£10 10s.

[1]SELENIUM — Per lb. in ton lots: Black, powdered, amorphous, 99.5 per cent pure, $2.25. London, 7s. 8d.@7s. 9d.

TANTALUM — Per gram: Bar and heavy sheet, chemically pure, 16c.; tantalum powder, 11c. Good demand; prices firm.

TELLURIUM—Per oz., 15@18c.

THALLIUM METAL—$12.50@$15 per pound.

TITANIUM—Per lb., 80@90 per cent grade, $5.

TUNGSTEN POWDER—Containing 97 to 98 per cent tungsten, per lb., $1.35@$1.50, depending on quantity. Nominal.

VANADIUM—Per gram, 92@95 per cent grade, $1.25.

[1]ZIRCONIUM METAL—Per oz., 98 per cent grade, $1.56 in 5- to 10-lb. lots.

[1]Price furnished by Foote Mineral Company, Philadelphia.

Metallic Ores

ANTIMONY ORE—Bolivian ore, 60 per cent metallic antimony, $1.35 per short ton unit, c.i.f. New York.

CHROME ORE—Per long ton, f.o.b. Eastern shipping points, Indian and Rhodesian ores, $21.50 for 47 per cent Cr_2O_3 ore to $23.50 for 50@51 per cent ore. New Caledonian ore, high-grade, $25.

IRON ORE—Per long ton, lower Lake ports. Lake Superior ores:

Mesabi, non-bessemer, 51½ per cent iron, $4.50. Old Range, non-bessemer, $4.65.

Mesabi, bessemer, 51½ per cent iron, $4.65. Old Range, bessemer, 51½ per cent, $4.80.

Eastern ores, cents per unit, delivered at furnaces: Foundry and basic, 56 to 63 per cent, 8c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

North African, low-phosphorus, 10@10½c.

Spanish and North African basic, 55@60 per cent, 10@10½c.

Swedish foundry or basic, 66@68 per cent, 9@10c.

Newfoundland foundry, 55 per cent, 8½@9c. Nominal.

MANGANESE ORE—Per long-ton unit of Mn, c.i.f. North Atlantic ports. Exclusive of duty. Brazilian and Indian ores, minimum 47 per cent Mn, 31@34c. Caucasian, 53@55 per cent, 36c.

Per ton in carload lots:

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent MnO_2. Brazilian and Cuban, $70@$80. Caucasian, minimum 85 per cent, $70. Montana, 70 to 75 per cent, $70@$80. Domestic, 70 to 72 per cent, $40@$50.

TANTALUM ORE—Per unit of Ta_2O_5, basis 60 per cent ore, $13.

TITANIUM ORE—Ilmenite, per gross ton, 50 per cent TiO_2, f.o.b. Atlantic seaboard, $9.50@$11, according to grade and impurities. Low-grade domestic, 32 to 35 per cent, about $7@$8 per gross ton. Rutile, per lb., guaranteed minimum 94 per cent concentrate, 10c. in carload lots.

TUNGSTEN ORE—Per short-ton unit of WO_3, N. Y.: Wolframite, $15.75@$16 for future delivery. Lack of definite knowledge of conditions in China tends to strengthen prices for near-by positions. Offerings light. Bolivian scheelite is quoted at $16. Western scheelite, $16.50@$17 for October and November delivery.

VANADIUM ORE—Per lb. V_2O_5 contained, 28c.

ZIRCON ORE—Per net ton containing 55 per cent ZrO_2, f.o.b. Atlantic seaboard, $40@$45 in 30-ton lots.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.

[1]Price given by Foote Mineral Company, Philadelphia.

[1]AMBLYGONITE—Per ton, f.o.b. mines: 8@9 per cent lithium oxide, $50@$60.

ASBESTOS — Per ton: f.o.b. Quebec mines, tax and bags included, prices quoted by leading interest for delivery on 1929 contract:

Crude No. 1, $550@$750; crude No. 2, $450@$575; spinning fibers, $225@$275; magnesia and compressed sheet fibers, $175@$225; shingle stock, $55@$115, various grades; paper stock, $45@$50; cement stock, $25; short fibers, $10@$20; floats, $12@$15. Europe reports a general shortage of Canadian spinning fiber and No. 2 crude.

Per ton c.i.f. New York: Rhodesian crude No. 1, $450; No. 2, $350.

BARYTES—Per ton: f.o.b. mines, bags extra:

Georgia: Barytes ore, crude (per long ton), $7. Washed and water floated to 97 per cent through 325 mesh, $18. Demand fair.

Missouri: Water ground and floated, bleached, $23; $25 in less than car lots, f.o.b. works. Crude ore, 93 per cent $BaSO_4$, not to exceed 1 per cent iron, $7.25 f.o.b. mines.

BAUXITE—Per long ton: Domestic ore, chemical, crushed and dried, 55 to 58 per cent Al_2O_3, 1.5 to 2.5 per cent Fe_2O_3, $7.50@$8.25 f.o.b. *Alabama* and *Arkansas* mines. Other grades, 56 to 59 per cent Al_2O_3, 5 to 8 per cent SiO_2, $6.75@$8.25 f.o.b. *Arkansas* mines. Pulverized and dried, $12@$14 f.o.b. *Arkansas* mines; calcined, 78 to 84 per cent Al_2O_3, $18@$20 f.o.b. *Arkansas* mines.

Per metric ton, foreign, c.i.f. Atlantic port: Dalmatian, 50 to 55 per cent Al_2O_3, 1 to 3 per cent SiO_2, $4.50@$6.50; Istrian, 54 to 57 per cent Al_2O_3, 3 to 5 per cent SiO_2, $5.50@$7; French, 56 to 59 per cent Al_2O_3, 2 to 5 per cent SiO_2, $6@$8.

BORAX—Per lb.: Carload lots, in bags, crystals, 2¾c.; granulated or powdered, 2½c.; f.o.b. shipping point.

[1]CELESTITE—Per ton in carload lots: 90 per cent $SrSO_4$, finely powdered, $27.

CHALK—Per ton: Crude in bulk, c.i.f. *New York,* $4.75@$5.

CHINA CLAY (KAOLIN)—Per ton: F.o.b. *Virginia* mines, crude lump, No. 1, $7; crude No. 2, $5.50; washed, $8; powdered and air-floated, $8@$15; ground. $7@$15.

Florida, pressed pottery, bulk, $13; ground, No. 1, $20; No. 2, $15. Sprayed mineral flour in 100-lb. bags (bags extra), No. 1, $20; No. 2, $17. Market fair.

Best grade, domestic, $16@$18, f.o.b. *Delaware* plants in carload lots.

Imported English, f.o.b. American ports: Lump, $13@$21; powdered, $40@$45.

DIATOMITE—Per short ton, f.o.b. producing plant:

Kiln-fired brick, $65; kiln-fired aggregate, ¼ in., $45; insulating powder, $25; natural aggregate, ¼ in., $18@$20; air-floated powder, $45; 80 to 85 per cent silica, 98 per cent through 200 mesh, $20 in carload lots.

EMERY—F.o.b. *Pennsylvania* and *New York* in 350-lb. kegs, per lb.: Greek Naxos, 6½c.; Turkish, 6½c.; Khasia, 6½c.; domestic, 3½c.

FELDSPAR—F.o.b. mine or grinding plant:

North Carolina, per long ton, No. 1 pottery grade, crude, $6.50@$7.50; glass grades, $5@$6.

No. 1, pottery, 140 mesh, $16; 200 mesh, $18. No. 2, enamel, 20 mesh, $10.25; 90 mesh, $12.75; 140 mesh, $13; 200 mesh, $14.75.

New Hampshire, per ton: Pottery grade, $8. Best quality lump, $9.

New York, per ton: f.o.b. cars, No. 1 crude, $9. Soda-potash feldspar, 140 mesh, first grade, $18 per short ton; 200 mesh, first grade, $20 per short ton.

Maine, per ton: Best pottery grade, ground, $19. Market slow.

FLUORSPAR — Per ton: F.o.b. *Kentucky* and *Illinois* mines:

Gravel, not less than 85 per cent CaF_2, and not over 5 per cent SiO_2, $18. Foundry lump, 85-5, $20. Ground, 95 to 98 per cent CaF_2, and not over 2½ per cent SiO_2, $32.50 in bulk; $36.50 in bags or barrels. Acid lump, 98-1, $32.50 in car lots.

New Mexico: 85-5 gravel, $16.50; 85-5 lump, $16.50; 93.3 lump, $23; ground 98, $35.

Foreign spar, duty paid, $19.40, tidewater.

FULLER'S EARTH — Per ton, f.o.b. *Florida:* 16 to 30 mesh, $16.50; 30 to 60 mesh, $18; 16 to 60 mesh, $17; 60 to 90 mesh, $14; 100 mesh up, $7.

Powdered, import duty paid, $24@$25 per ton.

GARNET—Per ton; domestic, f.o.b. mines, $85.

Spanish grades, $60, c.i.f. port of entry.

GILSONITE — Per ton, carload lots, f.o.b. mines *Colorado:*

Selected grade, $33; seconds (mine run), $25.50. Normal market.

GRAPHITE—Per lb., f.o.b. *New York:*

Ceylon lump, 8@9c.; chip, 6½@7½c.; dust, 2½@5c.; Madagascar flake, 6½@8½c.

No. 1 flake, 8@16c.; fine ground, 5@15c. Ordinary fine ground, 4@8c.; high grade, 8@12c.; amorphous, 3@7c. Agitation here to reduce the tariff. Trading rather quiet and competition severe.

Crude amorphous graphite, $15@$35 per ton, according to grade.

GREENSAND—Per ton, f.o.b. cars, *New Jersey:* Screened and bagged, best grade, in carload lots, $18.

GYPSUM—Per ton, f.o.b. mill, depending upon location: Crushed, $1.50@$5; ground, $4@$9; agricultural, $4@$8; calcined, $4@$13.

IRON OXIDE (See Ocher)—Per lb.: Standard Spanish red. 3@4½c.; domestic earth, 2@4½c.

KAOLIN—See China Clay.

[1]LEPIDOLITE—Per ton: $20@$30 for ordinary grades. Nominal.

LIMESTONE—Per ton: f.o.b. shipping points, depending on location, either lump or crushed, 25c.@$3.

Agricultural, 75c. up to $5 for crushed or pulverized. Prices depend upon source, purity, and fineness.

MAGNESITE — Per short ton, f.o.b. *California* mines: Grade "A" calcined, 80 per cent through 200 mesh, $43; Grade B, $40; dead burned, $29; crude, $11. *Washington:* Dead-burned magnesite, $22@$24 per net ton, Chewelah, Wash.

MICA—Per ton, f.o.b. plant:

New Hampshire: Mine run, $250; clean shop scrap, $25; roofing, $25. White dry ground, 20 mesh, $28; 40 mesh, $38; 60 mesh, white, $55; off-color, $34; 100 mesh, $70; 200 mesh, $80. Granite mica facings for cement block and stucco use, $8@$12, depending on size between ¼ in. and 60 mesh. Market somewhat firmer.

North Carolina: White, ground, 20 mesh, $35; 70 mesh, $100.

Madagascar, amber, per lb., f.o.b. *New York*, duty paid: No. A1, $2.50; No. 1, $2; No. 2, $1.65; No. 3, $1.15; No. 4, 60c.; No. 5, 45c.

[1]MONAZITE—Per ton: (Minimum 6 per cent ThO_2), $80.

OCHER — F.o.b. *Georgia* mines, per ton: $19@$20 in sacks; $21@$22 in barrels; washed and water floated, $18; second grade, 99 per cent through 225 mesh, $18. Market fair.

PHOSPHATE—Per long ton, f.a.s. or f.o.b. mines:

Florida, pebble, f.a.s., for export: 76@77 per cent, $7.15; 75 per cent, $6.40; 74@75 per cent, $6.15; 70 per cent, $4.65; 68 per cent, $4.10. Prices firm.

Florida, pebble, domestic: 76@77 per cent, $6.50; 74@75 per cent, $5.50; 72 per cent, $4.50; 70 per cent, $4. Dull.

Tennessee, ground, 80 per cent through 300 mesh, 33 per cent P_2O_5, $11.80 per short ton. Brown lump for acid manufacture, per gross ton, $6 on 75 per cent basis; $5.25 on 72 per cent basis. Non-acidulated, fine ground, 65 per cent, $8 (per short ton).

POTASH—The ruling contract prices (short tons) are as follows:

	Bags	Bulk
Muriate of potash, 80@85 per cent, basis 80 per cent..	$36.75	$35.15
Sulphate of potash, 90@95 per cent, basis 90 per cent	47.75	46.15
Sulphate of potash-magnesia, 48@53 per cent, basis 48 per cent	27.50	25.90
Manure salt, 30 per cent...	21.95	18.95
Manure salt, 20 per cent...	15.50	12.50
Kainit, 14@16 per cent ...	12.60	9.60
Kainit, 12.4 per cent.....	12.10	9.10

PUMICE STONE—Per lb.: In barrels, powdered, 2½@4c.; selected lump, 5@7c.

PYRITES—Per long ton unit of sulphur: C.i.f. United States ports; guaranteed 48 per cent sulphur: Spanish, 13c.; Tharsis, furnace size, 2½ in. diameter, 14c. Cinder from ore to remain property of buyers.

[1]QUARTZ ROCK CRYSTALS—Per lb. in ton lots: Colorless, clear but flawed, pieces ¼ to ½ lb. in weight, 20c. For optical purposes, four times above price; larger crystals still higher.

SILICA—Per ton: Water ground and floated, in bags, f.o.b. Illinois: 325 mesh, $16@$50 for 90 to 99½ per cent grades. Market fair. Glass sand, f.o.b. producing plant, 75c.@$5 per ton; molding sand, 65c.@$3.50; blast sand, $1.35@$3.50.

[1]SPODUMENE — Per ton: $20@$30, depending upon lithium content.

SULPHUR—Per long ton for domestic market, $18 f.o.b. Texas mines; $22 for export, Atlantic ports.

TALC—Per ton, carload lots, f.o.b. works, containers included:

Vermont: 99 per cent through 200 mesh, extra white, $9@$9.50; 97½ to 98½ per cent through 200 mesh, medium white, $8.50@$9; packed in 50-lb. paper bags; prices $1 per ton less in burlap sacks plus 15c. net for bags packed 12 to the ton.

New York: Double air-floated, short fiber, 200 mesh, $13.75; 325 mesh, $14.75.

Georgia: Powdered, gray, $7.50@$10; yellow, $9@$12; red, $11@$13; roofing, $7.50@$9.

New Jersey: Soapstone, ground, $10@$12.

TRIPOLI—Per short ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri:* Once ground through 40 mesh, rose and cream colored, $16. Double ground through 110 mesh, rose and cream, $18. Air-floated through 200 mesh, rose and cream, $27.50; mill run, $16. Fair summer business.

Metallic Compounds

ANTIMONY OXIDE—White, Chinese, 99 per cent Sb_2O_3, 10½@11c. per lb. Nominal.

ARSENIOUS OXIDE (White arsenic)—Per lb., 4c.; delivered near by. Market firm. London, per long ton, £16@£16¼ quoted for Cornish white.

CALCIUM MOLYBDATE OR MOLYTE — Per lb. of contained Mo, 95c., delivered.

COPPER SULPHATE (Blue Vitriol)—Per lb. in car lots, 6c., for either large or small crystals.

SODIUM NITRATE—Per 100 lb.; crude natural, in bags ex vessel, Atlantic ports, $2.10 for August deliveries.

SODIUM SULPHATE (Salt Cake)—Per ton, bags, f.o.b. works, $18@$20; in barrels, $22.

ZINC OXIDE—Per lb. in bags, in car lots: Lead-free, 6½c.; 10, 20 or 35 per cent leaded grades, 6⅝c.; French red seal, in bags, 9½c.

[1]Price furnished by Foote Mineral Company, Philadelphia.

Alloys

[1]FERROCERIUM—Per lb., $8 in 15 to 75 lb. lots.

FERROCHROME—Per lb. of contained chromium, 60@70 per cent chromium, 4 to 6 per cent carbon, 11c. on requirement contracts; spot shipments about 11½c. Freight allowed on carload lots east of Mississippi River and north of Baltimore. Demand good.

FERROMANGANESE — Per gross ton furnace: Domestic and foreign, 78@82 per cent, $105. Spiegeleisen, 19@21 per cent, $34 on carload business, f.o.b. furnace.

FERROMOLYBDENUM—Per lb. of Mo, f.o.b. shipping point, 50@60 per cent Mo, $1.20.

FERROPHOSPHORUS—Per ton, 18 per cent P, $91; electrolytic, 24 per cent, $122.50; f.o.b. *Alabama* and *Tennessee*.

FERROSILICON—Per gross ton, f.o.b. works, freight allowed on carload lots east of Mississippi River and north of Baltimore: 50 per cent, $83.50; 75 per cent, $130; 15@17 per cent, $45, f.o.b. Suspension Bridge, N. Y. Quotations for spot shipments $5@$10 per ton higher on 50 and 75 per cent grades.

FERROCARBONTITANIUM — Per ton: $160, f.o.b. producer's plant.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, $1.45 f.o.b. works. Market slightly higher.

FERROVANADIUM—Per lb. of V contained, f.o.b. works, freight allowed, $3.15@$3.50, depending on grade and quantity. Market continues active.

NICKEL SILVER—Per lb. for 18 per cent nickel Grade A sheets, 34½c.

YELLOW (MUNTZ) METAL—Dimension sheets, per lb., 25c.; rods per lb., 22½c.

Rolled Metals

COPPER—Sheets, hot-rolled, per lb., 27½c.; wire, per lb., f.o.b. mill, 19⅞c.

LEAD SHEETS—Full rolled, 11c. per lb.; clipped, 11¼c.

MONEL METAL—Per lb., sheets, full finished, 42c.; rods, hot-rolled, 35c.

NICKEL—Per lb., sheets, full finished, 52c.; rods, hot-rolled, 45c.

ZINC SHEETS—Per lb., 10½c., f.o.b. works.

Refractories

CHROME BRICK—Per net ton, f.o.b. shipping point, $45.

FIRECLAY BRICK — Per M.: First quality, $43@$46, *Ohio, Kentucky, Central Pennsylvania;* second quality, $35@$38.

MAGNESITE—Brick, per net ton, f.o.b. works: 9-in. straights, $65. Cement, $40, seaboard.

SILICA BRICK—Per M., *Pennsylvania* and *Ohio*, $43; *Alabama*, $51; *Illinois*, $52.

ZIRKITE—Per lb.; Powdered, 65@70 per cent ZrO_2, 3½c. Brick, straights, 80c.@$1 each.

Mining Stocks—Week Ended August 3, 1929

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda Copper	New York	120⅛	111	120	Jl. 13, Au. 19	Q 1.75
Andes Copper	New York	54½	49⅛	54	Jl. 13, Au. 12	Q 0.75
Arisona Com	Boston	2⅜	2⅛	2⅛	Jl. 16, Jl. 31	SA 0.25
Calumet & Aris	New York	134½	127½	134½	My.31, Je.17	Q 2.50
Calumet & Hecla	Boston	42½	40	40	My.31, Je.29	Q 1.00
Cerro de Pasco	New York	98⅛	92⅛	98⅛	Jl.11, Au. 1	Q 1.50
Con. Coppermines	N. Y. Curb	11⅛	10⅛	10⅛		
Copper Range	Boston	23	21⅛	22⅛	Je. 15, Jl. 15	Q 0.50
East Butte	Boston	2⅛	2⅛	2⅛	Dec., 1919	0.50
Granby Con	New York	85	75⅛	83	Jl.12, Au.1	Q 1.75
Greene Cananea	New York	180	169½	180	Je. 6, Jl. 1	Q 2.00
Howe Sound	New York	69⅛	63½	68	Je. 29, Jl. 15	Q 1.50
Hudson Bay	N. Y. Curb	18	16⅛	17⅛		
Inspiration	New York	47⅛	42½	47½	Je.13, Jl. 1	Q 1.00
Isle Royale	Boston	22½	20⅛	20⅛	My. 31, Je.29	0.50
Kennecott	New York	91½	83⅛	91½	My. 31, Jl. 1	Q 1.25
Magma Copper	New York	71⅛	64½	71½	Je.28, Jl.15	Q 1.25
Mason Valley	N. Y. Curb	1⅜	1⅛	1⅜		
Miami Copper	New York	45⅞	42⅛	45½	Au. 1, Au. 15	Q 1.00
Mohawk	Boston	57⅛	56	56½	Jl. 31, Se. 2	Q 2.00
Mother Lode	New York	3⅛	3	3⅛	Je. 13, Je. 29	0.20
Nevada Con	New York	49⅛	43⅛	49	Je. 14, Je. 29	Q 0.75
Noranda	N. Y. Curb	65⅛	57½	63		
Ohio Copper	N. Y. Curb	1⅛	1⅛	1⅛	Sept., 1926	0.03
Old Dominion	Boston	10	9½	9½	Dec., 1918	1.00
Phelps Dodge	New York	....	....	61	Je. 4, Jl. 1	Q 0.75
Quincy	Boston	47⅛	41½	45½	March, 1920	1.00
Roan Antelope	N. Y. Curb	43⅛	40⅛	43		
St. Mary's M. L.	Boston	38	37	38	Fe.25, Mr.12	2.00
Seneca Copper	New York	5⅛	4⅛	5⅛		
Shattuck Denn	N. Y. Curb	17⅛	15⅛	16⅛		
Sherritt-Gordon	Toronto	7.90	7.40	7.90		
Tenn. C. & C.	New York	18⅛	17⅛	17⅛	Au.31, Se.16	Q 0.25
United Verde Ex	N. Y. Curb	16⅛	15⅛	16⅛	Jl. 2, Au. 1	Q 1.00
Utah Copper	New York	301	301	301	Je. 14, Je. 29	Q 4.00
Waite-Ack.-Mont	Toronto	8.25	5.85	7.90		
Walker Mining	Salt Lake	5.00	4.75	4.97½		
Wenden Copper	N. Y. Curb	1⅛	1	1⅛		
LEAD, ZINC, SILVER						
Ahumada Lead	New York	1⅜	1⅛	1⅜		
Amer. Z. L. & S.	New York	29⅛	23	28	May, 1917	1.00
A. Z. L. & S., pfd.	New York	94⅞	91	92	Je.14, Jl. 1	1.50
Bunker Hill & S.	N. Y. Curb	129⅛	129⅛	129⅛	Ap.25, My.6	X 0.75
Butte Cop. & Zn.	New York	4⅛	4⅛	4⅛		
Butte Cop. Con.	Boston Curb	*31	*31	*31		
Butte & Sup.	New York	8⅛	8	8⅛	Je. 14, Je. 29	Q 0.50
Callahan Zn-Ld.	New York	1⅛	1⅛	1⅛	Dec., 1920	0.50
Chief Consol.	Salt Lake	3.57½	3.40	3.50	Fe. 1, 1928	K 0.10
Consol. Ld. & Zn. "A"	St. Louis	11⅛	11⅛	11⅛	Je.20, Jl.1	Q 0.25
Constitution	Spokane	*54	*48	*54		
Dayrock	Spokane	3.85	3.30	3.50	Je.20, Je.30	0.03
Dickens Consol	Spokane	*5⅛	*5	*5⅛		
Eagle-Picher	Cincinnati	20	18	18	Je. 30, Jl.15	Q 0.20
Eagle-Pich., pfd.	Cincinnati	...	...	102	Je. 30, Jl. 15	Q 1.50
Erupcion	Boston Curb	...	...	*12	Ja. 1, 1928	Q 0.07½
Eureka Bullion	Salt Lake	1.12½	*89	*99		
Eureka Lily	Salt Lake	...	...	*33		
Eureka Standard	Salt Lake	...	...	1.42½		
Evans-Wallower	N. Y. Curb	19⅛	15⅛	19⅛		
Evans-Wal., pfd.	N. Y. Curb	84	84	84	Je.20, Jl. 1	Q 1.75
Federal M. & S.	New York	....	....	280	Je., 1927	10.00
Fed. M. & S., pfd.	New York	99⅛	99⅛	99⅛	My.24, Je.15	Q 1.75
Gladstone	Spokane	*8	*7½	*7½		
Golconda	Spokane	1.05	1.03	1.03	Je.15, Jl.1	0.02
Grandview	Spokane	*44	*42	*42½		
Hecla Mining	N. Y. Curb	18⅛	17⅛	18⅛	My.15, Je.15	Q 0.25
Highland-Surprise	Spokane	*14½	*14	*14½		
Jack Waite	Spokane	*12	*9½	*9½		
Kootenay Florence	Spokane	*15½	*15	*15		
Lucky Jim	Spokane	*10	*9	*9		
Lucky Tiger-C.	Kansas City	†3.25	†3.00	....	Au. 1, Au. 10	0.02½
Mexican Premier	Spokane	2.50	2.40	2.40		
National Lead	New York	152	143	152	Se. 13, Se. 30	Q 1.25
Natl. Lead, pfd. A	New York	139½	138½	139½	Au.30, Se. 14	Q 1.75
Natl. Lead, pfd. B	New York	117	117	117	Oc. 16, No. 1	Q 1.50
N. J. Zinc, new	N. Y. Curb	85	82½	84½	Jl.20, Au.10	Q 0.50
New Quincy	Salt Lake	2.20	2.05	2.05	My.15, My.27	Q 0.10
Noble Five	Spokane	*61	58*	*60		
North Lily	Salt Lake	6.55	6.10	6.50	Jl.16, Jl.20	Q 0.25
Park Bingham	Salt Lake	8.00	7.50	7.75		
Park Utah	New York	6⅞	5⅞	6	Je. 14, Jl. 10	Q 0.20
Pend Oreille	Spokane	6.25	5.00	6.00		
Rico Argentine	Salt Lake	*36	*30	*31	No. 30, De. 15	Q 0.03
Ruth-Hope	Spokane	*35	*30	*32		
St. Joseph Lead	New York	73⅜	64⅜	70⅛	Se.10, Se.20	QX 0.75
Sherman Lead	Spokane	*59½	*55	*58		
Silver King Coa.	Salt Lake	12.50	12.50	12.50	Je. 20, Jl. 1	0.25
Silversmith	Spokane	*9½	*9	*9½	Oct., 1926	Q 0.02
Sunshine Mining	Spokane	4.60	4.42	4.42	Je. 10, Je. 20	Q 0.05
Tamarack-Custer	Spokane	*84	*76	*76	Sept., 1924	0.25
Tintic Standard	Salt Lake	13.75	13.00	13.50	Je. 17, Je. 29	QX 0.30
Tonopah Belmont	N. Y. Curb	....	....	*56⅛	Oct., 1925	0.05
Treadwell-Yukon	Toronto	9.50	9.00	9.50		
United Zinc Smg.	N. Y. Curb	....	....	*87½		
Utah Apex	Boston	4	3⅜	4	May 15, June 1	0.25
Utah Met. & Tun.	Boston	1⅜	1⅛	1⅛	Dec., 1917	0.30
Whitewater	Spokane	*60	*50	*50		
Yellow Pine	Los Angeles	....	....	*8	Dec., 1925	QX 0.04
GOLD						
Alaska Juneau	New York	6⅛	5⅜	6		
Barry-Hollinger	Toronto	*29	*27½	*29		
Central Manitoba	Toronto	*50	*43	*48		
Cresson Consol.	N. Y. Curb	*68⅜	*56½	*62½	Mr.30, Ap.10	Q 0.02
Dome Mines	New York	11½	10	10⅛	Jl. 20,	Q 0.25
Golden Cycle	Col. Springs	†1.88	†1.84½	....	Fe.15, Mr. 1	0.04
Gold Hill	Toronto	†*1½	†*1½	....		
Hollinger	Toronto	7.25	5.90	6.85	Jl.26, Au. 12	FW 0.05
Homestake	New York	74½	74½	74½	Jl.20, Jl.25	M 0.50
Kirkland Lake	Toronto.	*98	*82	*96		
Lake Shore	Toronto	26.00	25.00	26.00	Je.1, Je.15	Q 0.20
McIntyre-Porc.	New York	...	...	15⅜	Au.1, Se.2	Q 0.25
Portland	Colo.Springs	†*10	†*9	....	April, 1927	0.02
Rand Mines	New York	...	...	35	Fe. 21, '28	Am.Sh. 1.52
Siscoe	Toronto	*73	*63	*71		
Sylvanite	Toronto	1.20	1.05	1.19		
Teck-Hughes	Toronto	8.45	8.10	8.55	Jl. 18, Au. 1	0.15
Tom Reed	Los Angeles	*74	*70	*70	Dec., 1926	0.02
Unity Gold	N. Y. Curb	1⅛	1⅛	1⅛		
Vipond Consol	Toronto	*90	*82	*90	April, 1927	0.03
Wright-Hargreaves	Toronto	1.95	1.70	1.84	Oc. 16, No. 1	0.02½
Yukon-Alaska	N. Y. Curb	....	....	35⅛		
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	20⅛	19	19		
Castle-Trethewey	Toronto	*31	*30	*30		
Consol. Cortes	N. Y. Curb	....	....	*12½		
Dolores Esperanza	N. Y. Curb	....	....	*81½	July, 1923	0.05
Keeley	Toronto	*46	*46	*46	Mr.13, 1928	0.04
Mining Corp.	Toronto	4.40	4.00	4.25	My.30, Je.13	0.12½
Montana-Idaho	Spokane	*8⅛	*7⅛	*7⅛		
N. Y. & Hond. Ros.	N. Y. Curb	...	...	16⅛	Jl.17, J1.27	QX 0.50
Nipissing	N. Y. Curb	2⅛	2⅛	2⅛	Je.29, Jl.20	Q 0.07½
Premier Gold	N. Y. Curb	1⅛	1⅛	1⅛	Je.13, Jl.3	Q 0.06
Tonopah Exten.	N. Y. Curb	....	....	*10	April, 1925	0.05
Tonopah Mining	N. Y. Curb	....	....	3	Ap. 7, Ap. 20	0.07½
United Eastern	N. Y. Curb	....	....	*56⅛		
Yukon Gold	N. Y. Curb	¼	¼	¼	June, 1918	0.02
IRON AND STEEL						
Bethlehem Steel	New York	125	120	123⅜	Oc. 18, No. 15	Q 1.50
Beth. Steel, pfd, 7%.	New York	123⅛	121⅛	123⅛	Se.6, Oc.1	Q 1.75
Cleveland-Cliffs	Cleveland	98⅛	97½	98	Je. 6, Je. 15	5.00
Colo. Fuel & Iron	New York	70⅛	65	68		
Colo. F. & I., 1st pfd.	New York	....	....	133	Au.10, Se.26,	Q 2.00
Great Northern Iron.	New York	31	29½	30⅛	Dec.15,	K 2.00
Inland Steel	New York	97⅜	93½	94	Au.15, Se. 1,	Q 0.87½
Republic I. & S.	New York	112⅜	107½	111⅜	My. 11, Je. 1,	Q 1.00
Republic I. & S., pfd.	New York	112½	112	112½	Je .12, Jl. 1,	Q 1.75
Sloss-Sheffield S. & I.	New York	61½	59½	59½	Mr. 11, Mr.20,	Q 1.50
Sloss-Sheff. S. & I., pfd.	New York	80½	79⅜	80	Je.20, Jl.1,	Q 1.75
U. S. Steel	New York	215⅛	204⅜	214½	Au. 29, Se. 28,	Q 1.75
U. S. Steel, pfd.	New York	140⅛	139⅜	140⅛	Au. 5, Au. 30,	Q 1.75
Virginia I. C. & C.	New York	22	21	22	Jan., 1924	1.50
Virginia I.C.& C., pfd.	New York	42	42	42	Jl.16, 1928	SA 2.50
MISCELLANEOUS						
Aluminum Co. of Am.	N. Y. Curb	524½	440	524½		
Alum.Co.of Amer., pf.	N. Y. Curb	106½	106	106½	Mr.15, Ap.1,	Q 1.50
American Metal	New York	72	60½	72	Au. 21, Se. 1	Q 0.75
Amer. Metal, pfd., 6%	New York	122½	120	122½	Au. 21, Se. 3	Q 1.50
Amer. Sm. & Ref.	New York	117⅛	108⅛	117⅛	Je. 30, Jl. 12	Q 1.00
Amer. Sm. & Ref., pfd.	New York	135	134½	134½	Au. 3, Se. 1	Q 1.75
Ang. Ch. Nitrate	N. Y. Curb	41	35	41		
Asbestos Corp.	Montreal	10	10	10	Jan. 1926	1.50
Asbestos Corp., pfd.	Montreal	33	31	33	De. 31, Ja. 15	Q 1.75
Consol. M. & S.	Montreal	385	380	380	Je.29, Jl.15,	SA X6.25
De Beers Consol.	New York	....	....	23	Jl. 23, Jl.26,	Q 0.96
Federated Metals	N. Y. Curb	29	29	29	Je.25, Jl.5	Q 0.75
Freeport Texas	New York	43	41⅞	42½	Jl. 5, Au.1	Q 1.00
Int. Nickel Can.	New York	52⅛	46⅛	52⅛	Je.1, Je.29	Q 0.20
Int. Nickel, pfd.	New York	....	....	122	Jl.1, Au.1	Q 1.75
Mayflower Assoc.	N. Y. Curb	83	73⅛	83		
Metal & Mining	N. Y. Curb	20⅛	19	20⅛	Je.20, Jl.1	Q 0.30
Newmont	N. Y. Curb	216½	200⅛	218	Je.29, Jl.15	Q 1.00
Patiño M. & E.	New York	40⅛	39⅛	40⅛	My. 31, Jn. 28	4s
So. America G. & P.	N. Y. Curb	2⅛	2⅛	2⅛		
Texas Gulf Sulphur	New York	73½	71⅛	71⅛	Je.1, Je.15	Q 1.00
U. S. Sm. R. & M.	New York	57⅛	53	57⅛	Jl. 5, Jl. 15	Q 0.87½
U. S. Sm. R. & M., pfd.	New York	52	50⅛	50⅛	Jl. 5, Jl. 15	Q 0.87½
Vanadium Corp.	New York	90⅛	86	86	; Au,1 Au. 15	Q 0.75

Toronto Standard Stock Exchange, Toronto, courtesy the Arthur E. Moysey Co.; Salt Lake Stock Exchange, courtesy J. A. Hogle & Co. and Logan & Bryan, New York; Standard Stock Exchange, Spokane, courtesy Pohlman Investment Company.

*Cents per share. †Bid or asked. Q, Quarterly. A. Annually. SA, Semi-annually. M, Monthly. BM, Bimonthly. FW, Four weeks. K, Irregular. I, Initial. R, Resumption. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

LONDON QUOTATIONS—WEEK ENDED July 23, 1929

	High	Low	Last	Date	Amount
Alaska Mexican ($5)	20/—	20/—	20/—		
Alaska Treadwell (25)	61/3	57/6	60/—	Nov., 1926	4 p.c.(d)
Aramayo Mines (25 frs.)	64/4½	61/10½	62/6	Aug., 1929	5 p.c.(c)
Burma Corp (10 rupees)	18/10½	17/11½	18/1½	July 1929	9 annas*
Bwana M'Kubwa (5s)	21/3	20/1½	20/7½		
Camp Bird (2s)	2/1½	1/10½	2/—	April, 1928	16⅔ p.c.
El Oro (5s)	3/—	2/9	3/—	Nov., 1924	2½ p.c.* (c)
Frontino & Bolivia (£)	7/1½	7/1½	7/1½	Jan., 1929	3½ p.c.
Mexican Corpn. (£1)	16/3	15/7½	16/—		
Mexico Mines of El Oro (£1)	3/1½	3/1½	3/1½	Dec., 1926	3½ p.c.*
Mount Isa (£1)	43/—	42/—	43/—		
N'Changa Copper Mining. (£1)	70/—	61/10½	63/9		
Oroville Dredging (4s)	2/—	1/10½	2/—	Nov., 1928	31½ p.c
Rhodesian Congo Border (£1)	198/9	186/3	192/6		
St. John del Rey (£1)	17/—	16/1½	16/9	Apr., 1929	7½ p.c.
San Francisco Mines (10s)	36/—	35/—	35/9	June 1929	15 p.c.
Santa Gertrudis (£1)	9/10½	9/4½	9/9	July 1929	7½ p.c.
Selukwe (2s. 6d.)	7/9	6/10½	7/—	April, 1917	6⅔ p.c.
S. Amer. Copper (2s.)	3/3	2/10½	3/—	Nov. 1917	75 p.c.
Tanganyika (£1)	58/9	55/—	56/3	July, 1928	5 p.c.
Union Miniere du Haut-Katanga (Brussels)	11,000	10,500	10,500	April, 1929	300 fr (‡)

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian francs and free of taxation. (d) U. S. Dollars. (c) July, 1929, ex ½d. return of capital.